CE

JuLI™ Stage

Automated cell imaging system

NEW PARADIGM FOR CELL BASED ASSAY

User Manual

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NanoEnTek

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JuLI™ Stage User Manual

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The information in this manual is described as accurately as possible. The changes involved in firmware and software may be applied without notification.

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Product components

The JuLI™ Stage, Automated cell imaging system is shipped with the following components.
Please check all components listed below when the instrument is delivered.
PC will be shipped separately because it is optional.

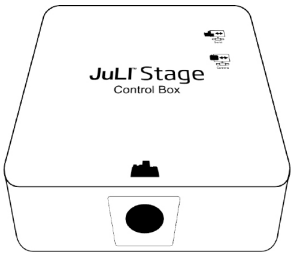
If any item is missed of damaged, contact your local distributor or e-mail sales@nanoentek.com.

JuLI™ Stage main instrument

1 EA

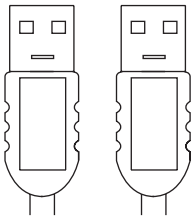
Control Box

1 EA



USB Cables (20 ~ 43 cm)

2 EA



Power cord with 4 adaptor cords

(4 pcs/set, for U.S./Canada/Taiwan/Japan, Europe or UK)

1 SET

Connection Cable

1 EA

Objective lens (4x, 10x, 20x)

3 EA

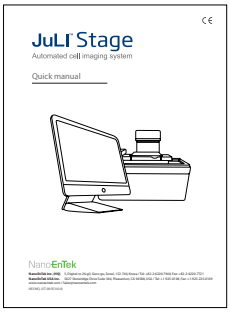
10x lens is factory-installed with the JuLI™ Stage main instrument.

User manual

1 EA

Quick manual

1 EA



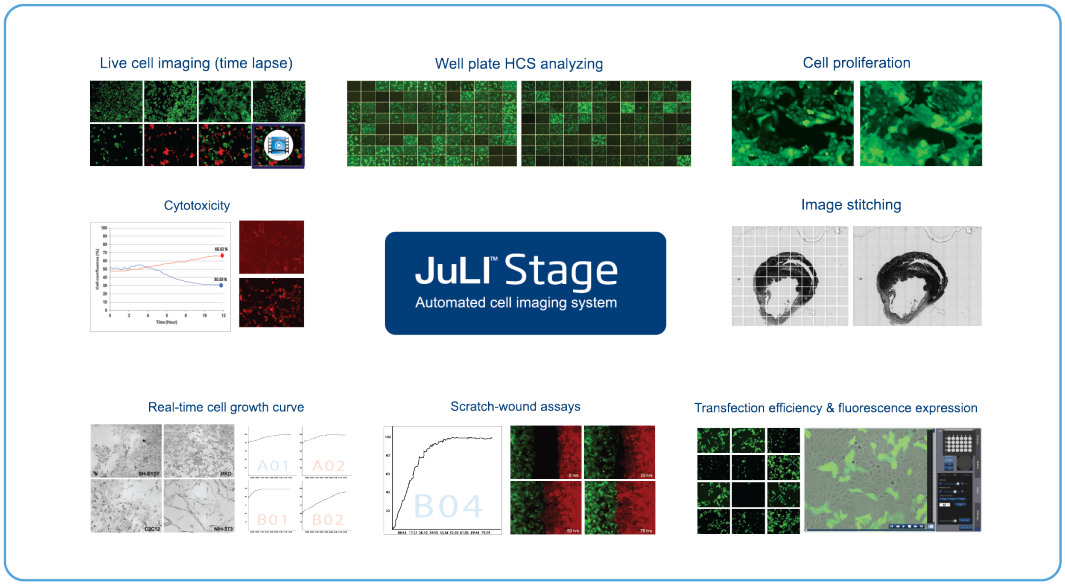
Product overview

A fully-automated, fluorescence live cell imaging system that acquires cell images directly from various cell culture plates (6 to 384 well) and dishes in an incubator. JuLI™ Stage supports multi-channel fluorescent colors, multiple objective lenses, and sensitive filter-based optics to optimize for various live cell assays. In addition, it enables users to support quantified cellconfluence results with low variation and the growth curve using image-based analysis with bright field.

Compact, compatible and automated fluorescence cell imaging system of live cell imaging from inside your cell culture incubator!

Suitable for the following applications:

- Live cell imaging (time lapse)
- Cell culture quality control
- HCS cell imaging analysis (6 to 384 well)
- Cell-based assay optimization
- Image stitching
- Angiogenesis
- Scratch-wound assay
- Neurite growth
- Angiogenesis
- Protein expression
- Kinetic imaging and cell differentiation
- Cell growth monitoring
- Cell culture optimization
- Stem cell development
- Cell proliferation
- Cell cytotoxicity
- Cell migration study
- Cell differentiation



Features

The JuLI™ Stage an automated cell imaging analyzer, offers you the following benefits,

Automated imaging system

The JuLI™ Stage provides a live cell imaging using automatic focus and precise one by one multi-well control system.

- Fully automated and motorized X-Y scanning stage
- Auto focusing on every single position
- Image tiling with a stitching function

Sensitivity and expandability

The sensitive CCD camera, multi-channel fluorescence and magnification (4, 10 & 20 X) provide the powerful detection capabilities required for various cell-based assays.

- High-sensitivity monochrome CCD
- Multi-channel fluorescence imaging (3 color fluorescence (GFP, RFP and DAPI) and bright channel)
- User-changeable objective lens (4, 10 & 20 X)

Versatile and Powerful S/W

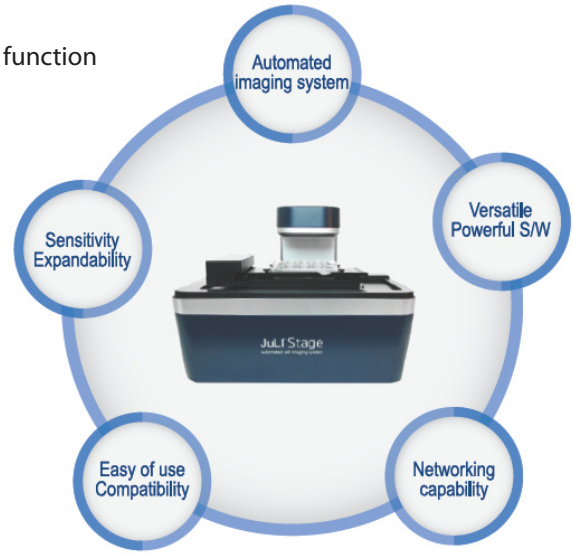
The JuLI™ Stage software allows you to generate live cell imaging and analysis easily.

- Image capturing and time-lapse recording with multi-position scanning
- Navigation function to figure out the optimal position
- Image stitching function to scan the whole well at once

Compatibility and easy to use

The compact and ready to use system can be operated in an incubator and it can be controlled by the JuLI™ Stage software from outside.

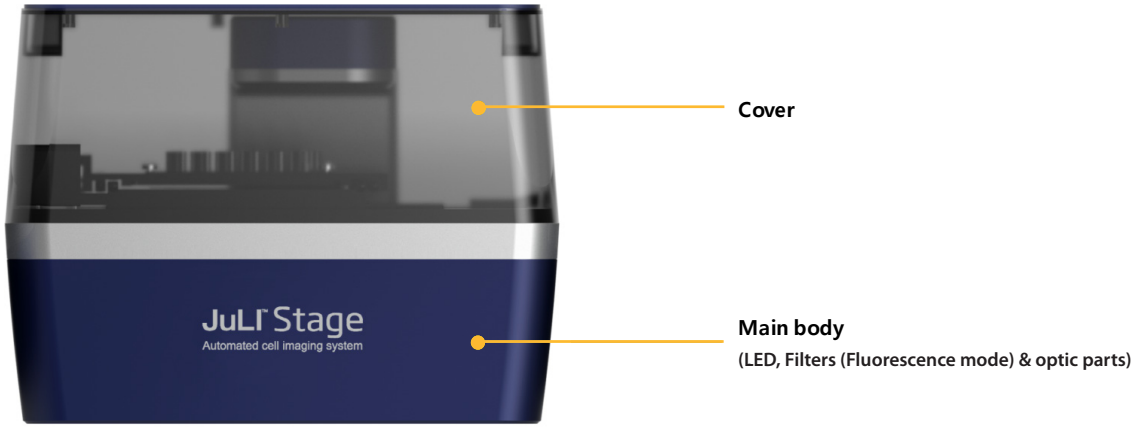
- Compact and compatible to CO2 incubator
- 23" full HD All-in-one touch screen PC control
- Simple steps for the system setup and operations
- Compatibility with various brands of well plates by auto adjustment function



Description

Front view

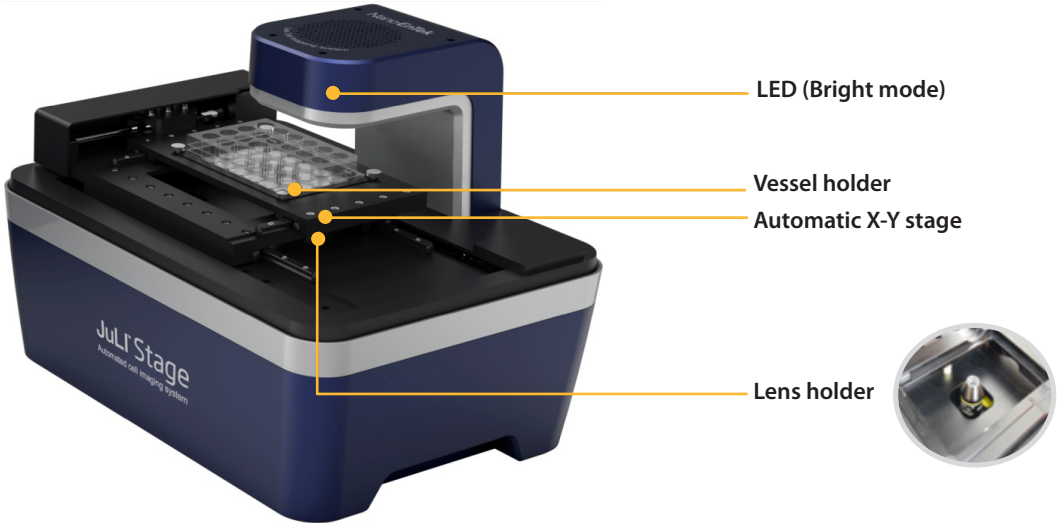
Cover	Used to protect test samples from external light. When you use the JuLI™ Stage in an incubator, the cover can block out light from the outside.
Main body	Front view of the JuLI™Stage.The main body is composed of LED, Filters (Fluorescence mode) and optic parts.



[Front view]

Side view

LED (Bright mode)	LED is used for bright image viewer.
Vessel holder	This is a holder for sampling plates. The capacity is 6 well to 384 well.
Automatic X-Y stage	The automatic X-Y stage makes it possible for you to move to the position you want.
Lens holder	This is a holder for changeable lens.

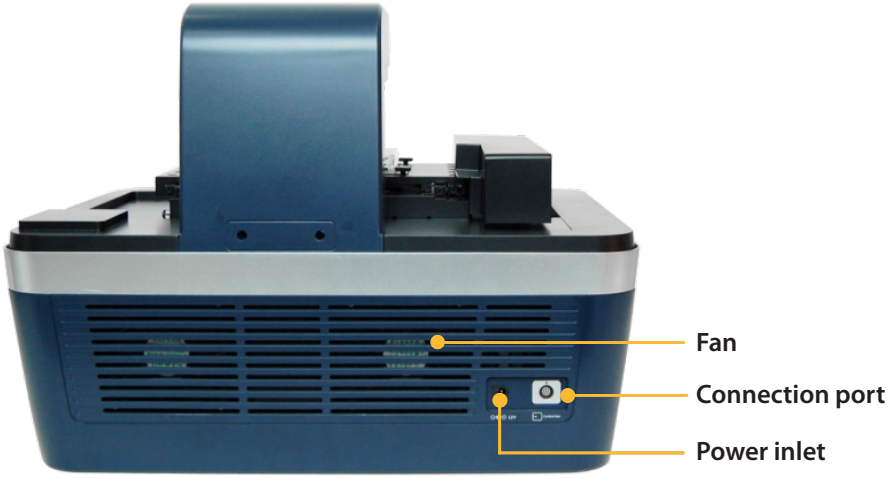


[Side view]

Description

Rear view

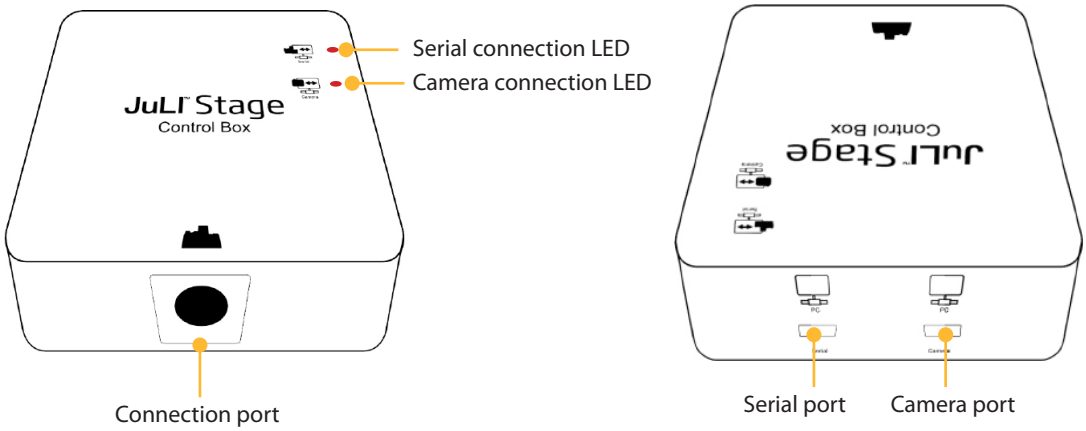
Fan	Machinery cooling system.
Connection port	Connect the JuLI™ Stage main instrument with the control box.
Power inlet	Connect the instrument to an electrical outlet using the supplied power cord and the appropriate plug, based on the electrical outlet configuration in your country.



[Rear view]

Control box

Serial and camera LED	When the PC and the control box are properly connected, the red light is turns on.
Connection port	Connect the JuLI™ Stage main instrument with the control box
Serial port	Control the camera in the JuLI™ Stage main instrument.
Camera port	Control the JuLI™ Stage main instrument operating.



Installation

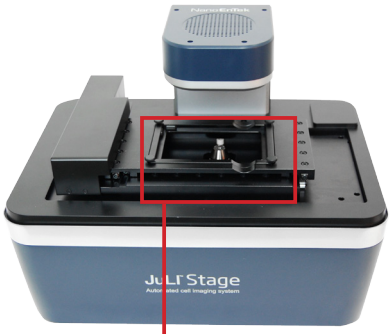
Unpacking the instrument

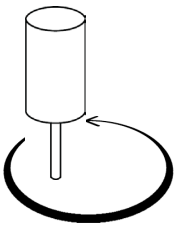
1. Open the box and remove the **material foam** in the box.
2. Carefully lift the instrument out of the box, holding it by handholds in the **bottom of the base.**
3. Place the instrument on a flat, level surface (table or incubator).

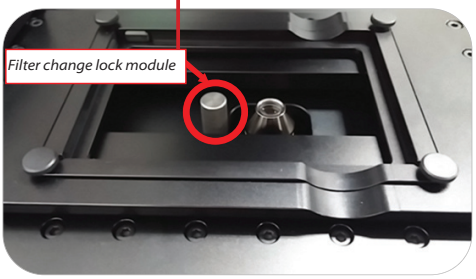
⚠ ***IMPORTANT!***
Do not lift the JuLI™ Stage by condense arm.

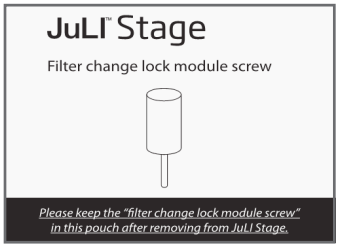
Remove the filter change lock module

1. Unscrew the **filter change lock module screw** until they spin freely.
2. Gently pull filter change lock module screw out, away from the instrument.
3. Put the filter in the pouch to keep.








JuLI Stage
Filter change lock module screw
Please keep the "filter change lock module screw" in this pouch after removing from JuLI Stage.

⚠ ***IMPORTANT!***
Remove out the Filter change lock module by turning it counterclockwise to prevent the damage of the instrument before plugging the power cord into power outlet and turning on the JuLI™ Stage.

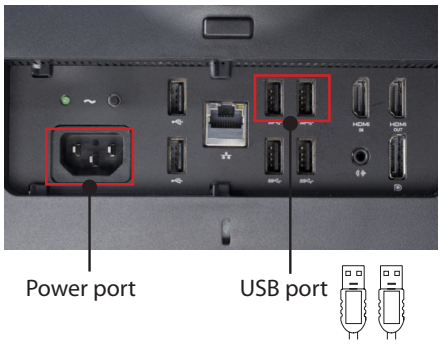
Installation

Install the instrument

1. Connect the **PC** and the **Control box** (Serial port, Camera port) using two **USB cables**. (PC Monitor Resolution: 1920 ×1080 pixels)

☞ *Note: Check the connection on the **rear side** of the PC.*

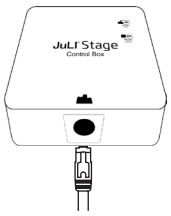
1-1. Plug the power cord into the rear side of the PC.



2. Connect the **JuLI™ Stage instrument** and the **Control box** and using the connection cable.

☞ *Note: Make sure for connection port direction of control box before connecting.*

2-1. Plug the power cord into the **rear** of instrument.



3. Plug the power cord of PC and instrument into the electrical outlet.

☞ *Note: Be sure to use only the power cord supplied with your instrument.*
Powering the instrument with an unapproved power cord may damage the instrument.

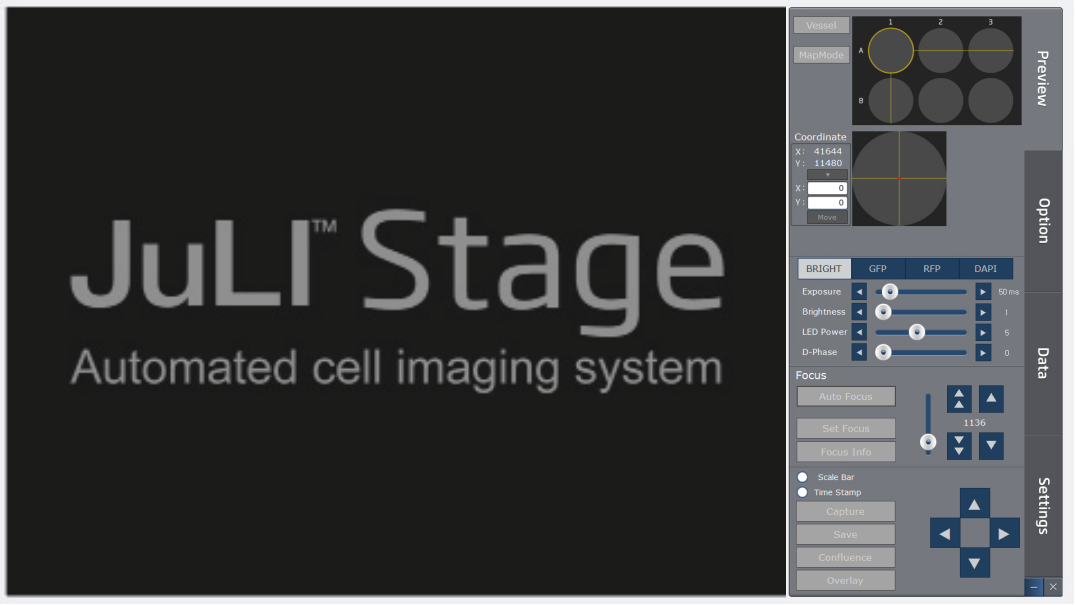
Installation

Install the instrument

4. Turn the PC and the Control box on by pressing the **Power button**.

5. Double-click the JuLI™ Stage icon on Desktop. The JuLI™ Stage software starts up.

☞ *Note: The JuLI™ Stage will be ready to use after initialization is completed when power on.*



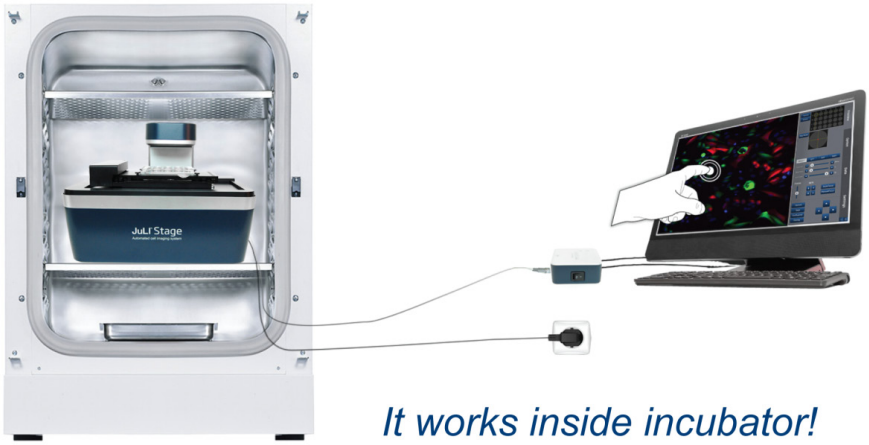
Installation

Place the instrument into the incubator (or to the table)

Live-cell images from various cell culture dishes are directly captured in a cell culture incubator. This design allows an instrument to be installed in an incubator, and prevents the contamination by maintaining a sterile environment. The intuitive graphic user interface also provides quick and convenient use in a cell culture incubator while capturing time-lapse imaging.

The JuLI™ Stage operates in standard size of incubator. The JuLI™ Stage can be used in both inside and outside incubator.

JuLI™ Stage installed inside of the incubator



JuLI™ Stage installed on the table

⚠ ***IMPORTANT!***

Lay a cover if the instrument is installed on the table to protect test samples from external light.

Installation

Operating environment

• Allow at least 10 cm (4 inches) free space at the back of the instrument to allow for proper ventilation and prevent overheating of electronic components.

• Set up the JuLI™ Stage away from direct light sources, such as windows. Ambient room lighting can enter the imaging path and affect the image quality.

• Place the JuLI™ Stage on a level surface away from vibrations from other pieces of equipment.

• Operating temperature range: 5° - 40°C (41° - 104°F)

• Relative humidity range: 20 - 95 %.

Cautions

⚠ ***IMPORTANT!***

The JuLI™ Stage is optimized into standard size of cell culture incubator.
It is recommend that the temperature should be stabilized in case of a small size incubator before using the instrument.

Warm up the JuLI™ Stage for 2 hours before monitoring.
The power should be on when warming up the instrument.

The well plate's cover should be wetted by the cell culture media before monitoring.
This step is required to avoid condensation inside the well plate cover for monitoring.

Avoid exposing the JuLI™ Stage to UV light.
UV light may degrade components, including plastics. Damage from UV exposure is not covered under the manufacturer's warranty.

Always wipe the surfaces with ethanol-soaked paper towels.
Do not directly spray ethanol anywhere on the JuLI™ Stage.

User interface

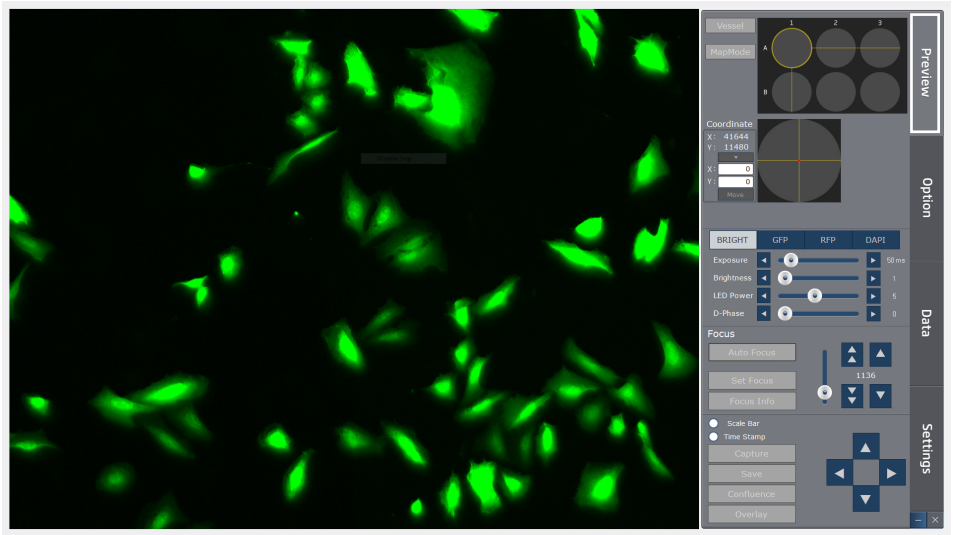
GUI

The JuLI™ Stage software allows you to generate live cell imaging and analysis easily.

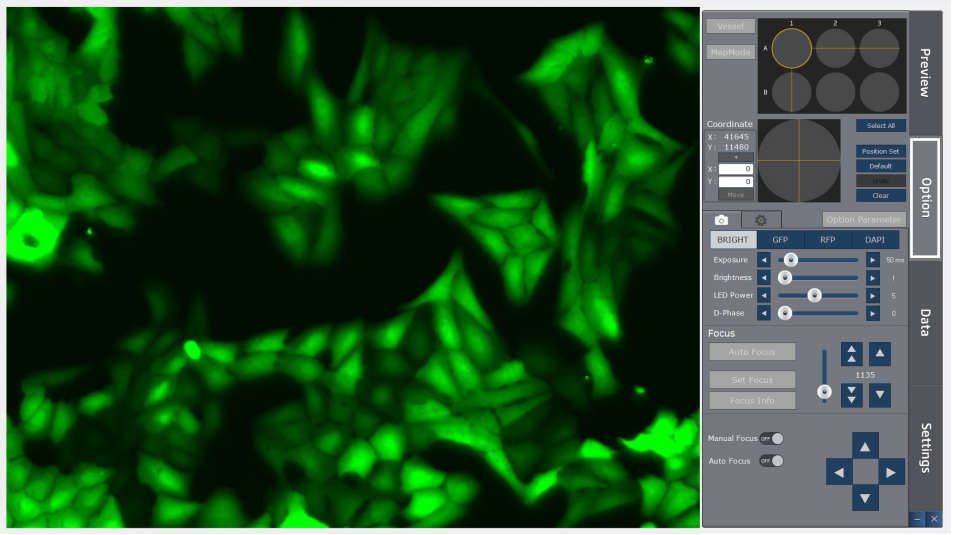
- Image capturing and time-lapse recording with multi-position scanning
- Navigation function to figure out the optimal position
- Image stitching function to scan the whole well at once

The JuLI™ Stage is a fully automated imaging system controlled by the integratedthe JuLI™ Stage software. The software, accessed the mouse, controls the automated X-Y axis stage and features imaging and analysis tools.

Preview menu



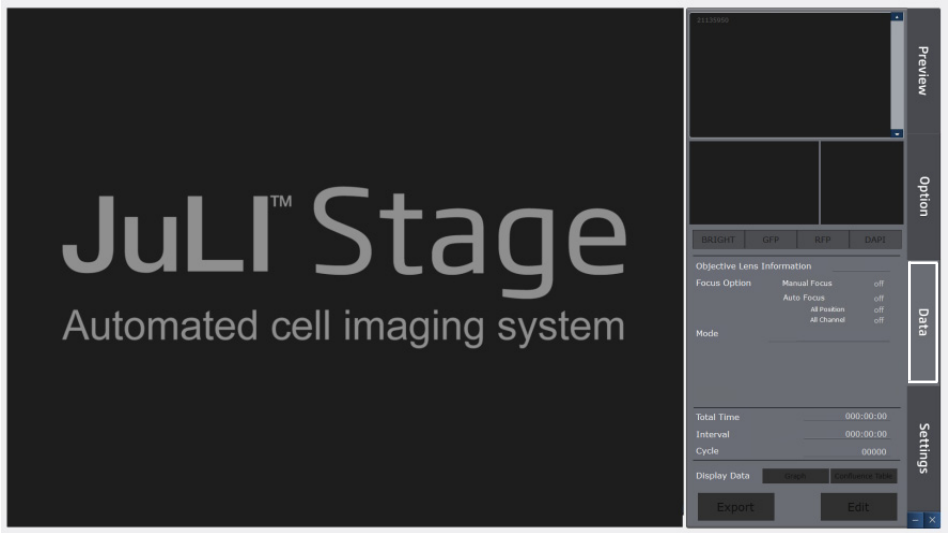
Option menu



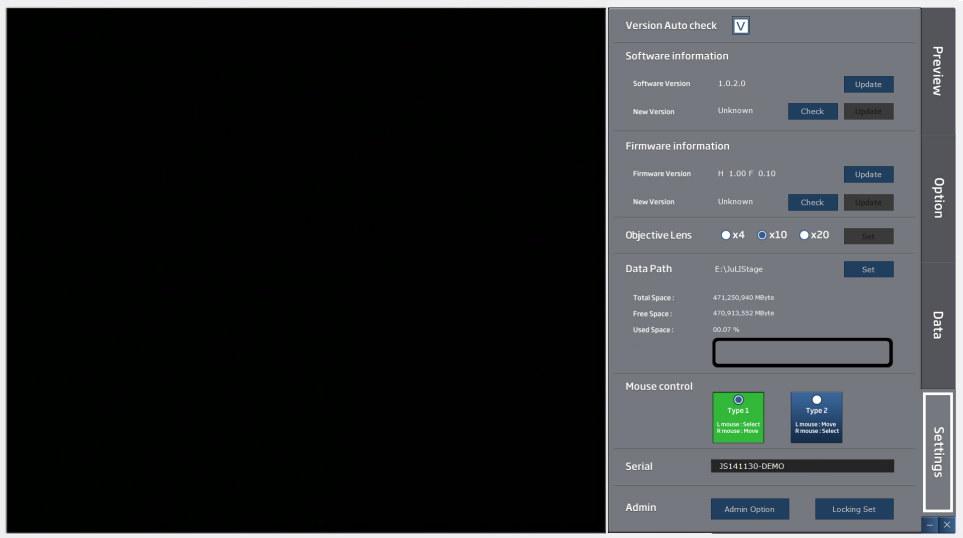
User interface

GUI

Data menu



Setting menu



Basic operation

The JuLI™ Stage can be used in combination with PC (Monitor Resolution 1920x1080) which enables users to operate the instrument using the computer mouse and keyboard. The JuLI™ Stage basic operations use the **mouse** for moving, selecting and zooming in/out. The detailed explanations are listed below.

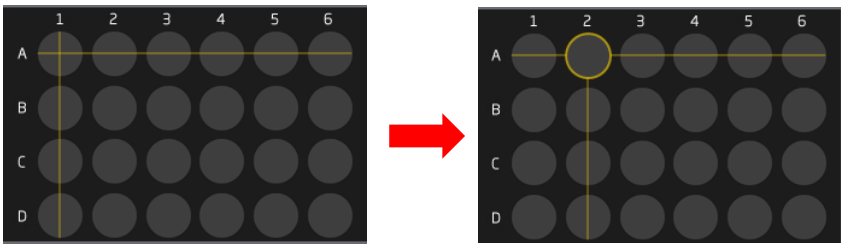
☞ *Note: This manual describes the mouse function in **Default setting (Type 1)**.*
*If necessary, you can change the mouse setting type the **Setting menu**.*

Moving

Right mouse

1) Inter well: Moving among wells

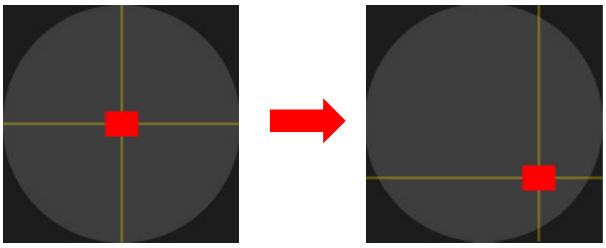
Move the stage to the well you want by clicking the Right button of the mouse in both preview and option menu.



The stage is moved from A-1 to A-2 by clicking the right button of the mouse.
The selected well is marked by a yellow circle as shown above.

2) Intra well: Moving within the well

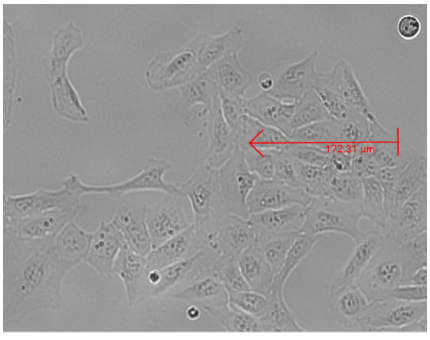
The stage is moved to a position you have selected on the navigation window by clicking the right button of the mouse in both preview and option mode.



The stage focuses in the center of the well when the well is selected. The selected image is marked by **red square** when the specific spot is selected by clicking the right button of the mouse.

3) Moving in view

The stage is moved to the spot you assigned in the view field by **Dragging with the right button** in both preview and option mode. The moving distance is marked by a red line as below.



Basic operation

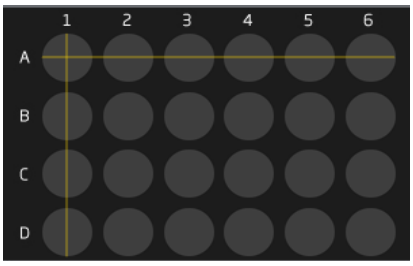
Selection

Left mouse

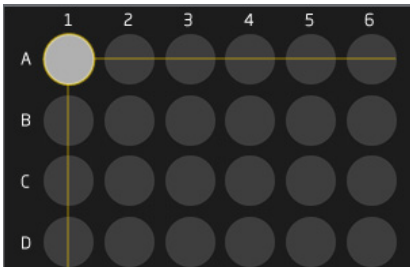
1) Selecting well

The well is marked by a grey color when the specific well is selected by clicking The **Left button**. Click once to select and click once more to deselect.

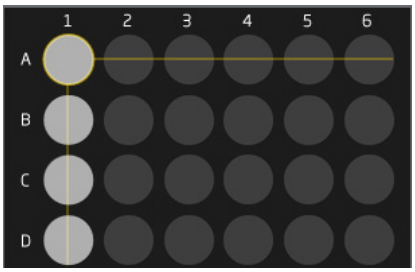
☞*Note: The JuLI™ Stage supports selecting function only in the **Option menu.***
*The selecting function does not work in the **Preview menu**.*



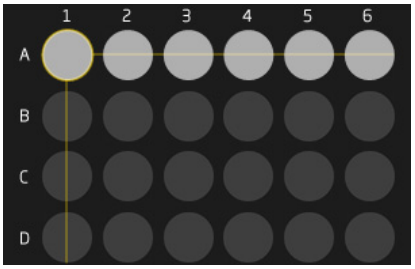
None of 24wells is selected



The selected well **A-1** is marked by a **grey color** by **pressing** the **specific well.**

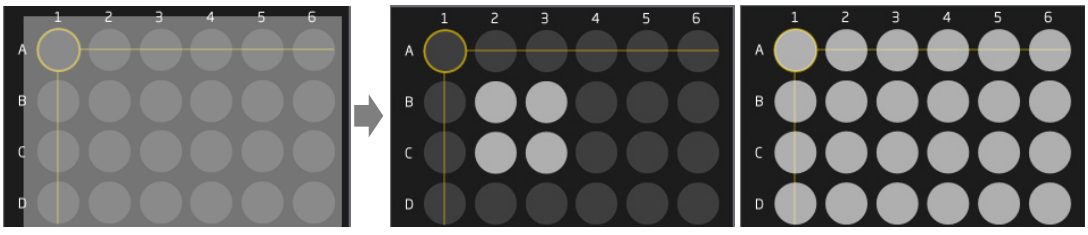


The **first well line** is marked by a grey color when **pressing line 1.**



The "A" well line is marked by a grey color when **pressing line A.**

☞ *Note: Deselection: **Select** each well again or **drag** the selected wells with the **Shift key** on the keyboard.*



Select any well or any well lines with the left mouse button by **dragging.**

☞ *Note: Deselection: **Select** each well again or **drag** the selected wells with the **Shift key** on the keyboard.*

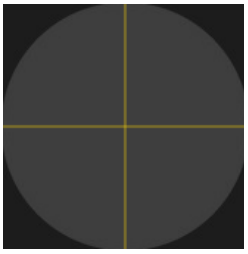
Basic operation

Selection

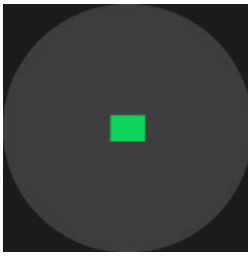
Left mouse

2) Selecting position

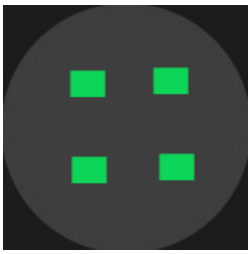
When the specific position well is selected by clicking the **Left button**, the assigned position is marked by **Green square** in the Navigation window. Press the **Position set button** in order to confirm.
The JuLI™ Stage supports the multi-selection functions.



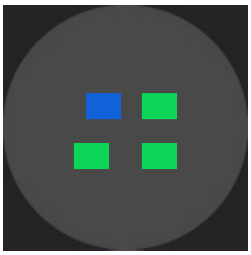
None of the positions in the Navigation window are selected.



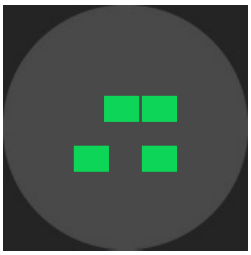
The **Green square** appears in the center of the well when pressing the **Default button.**



The JuLI™ Stage allows users to select **more than one position** in a well by clicking the **Left button.**



Click the selected position with **Left button** of the mouse and drag to move the position within the well.

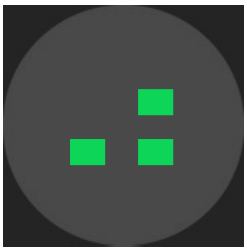


Click the selected position with **Left button** of the mouse and drag with **Shift button**. Then the selected position stick in conti-guity with positon that you want.

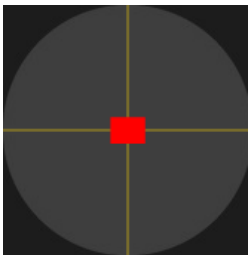
Basic operation

Selection

Left mouse



Double click the position to delete.



Press the **Position set button** to save your setting that the green square will change to a **Red square**.

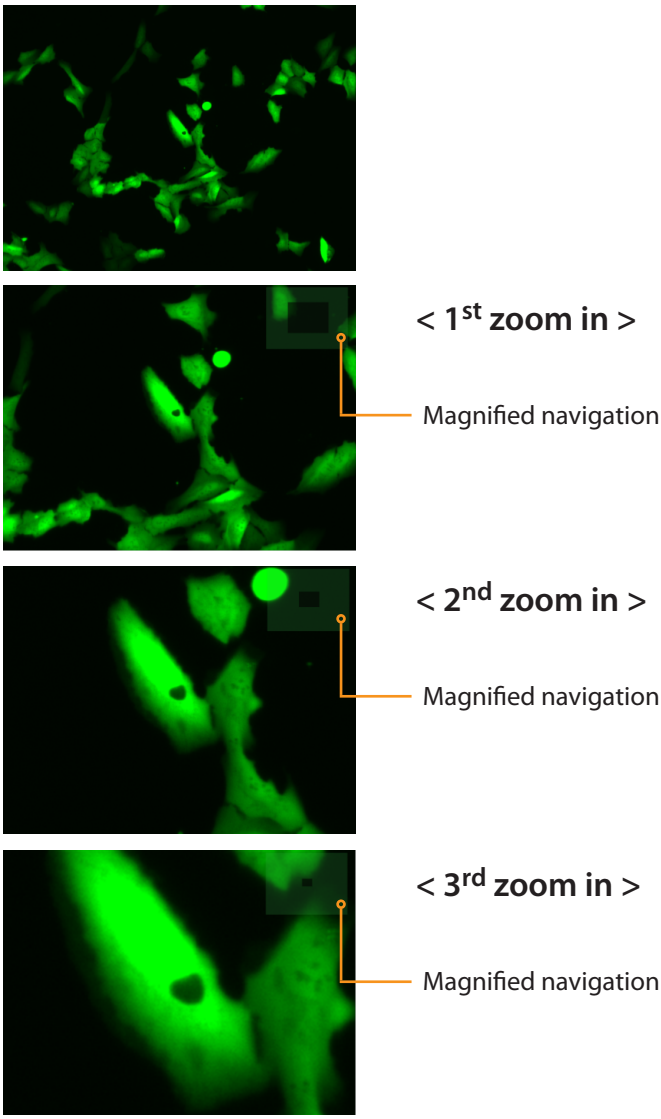
Basic operation

Zoom

Mouse wheel
(Up and down)

1) Zoom-in

Scroll up in the view field to use the zoom in the image.
The JuLI™ Stage supports zoom-in function in both the real view and captured images that allows users to magnify specific position by scrolling up.



2) Zoom-out
After zooming in, **Scroll down** to zoom out the view field in both real view and captured images

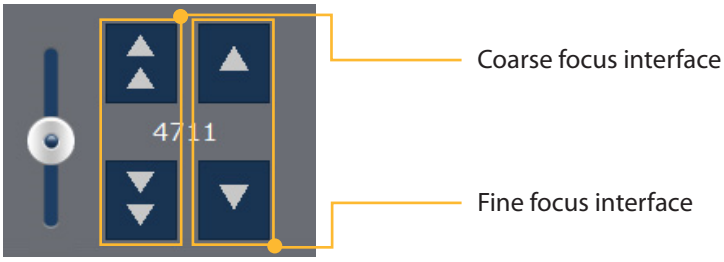
Basic operation

Focus

Mouse wheel
(Up and down)

3) Focus adjustment

Scroll up or down with **Shift key** on the keyboard for fine focus adjustment.
It is a same function with the **Fine focus interface** in the menu



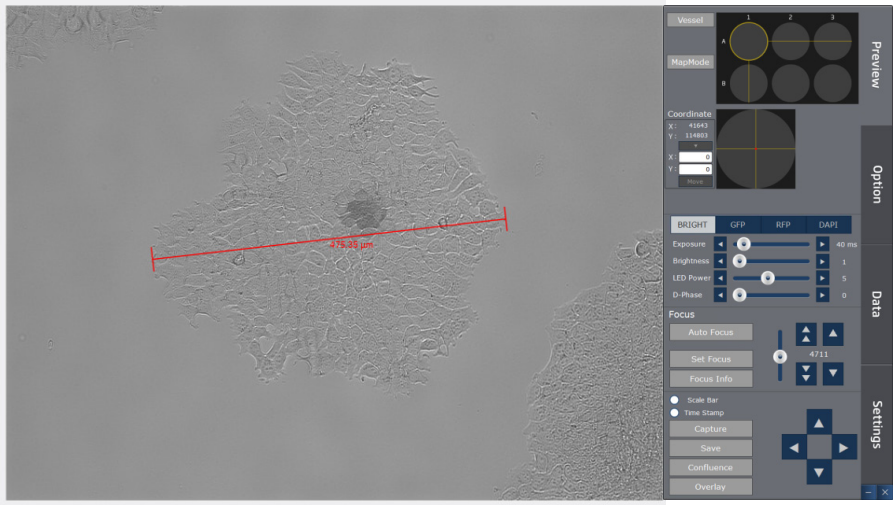
☞ *Note: Coarse focus function is in the menu. It is not supported by using the mouse wheel.*

Size bar

4) Size bar

The JuLI™ Stage enables users to check **Sample size** and moving distance by **wheel dragging.**

☞ *Note: The size bar function is supported in the both Preview and Option menu.*



Basic operation

Auto Focus

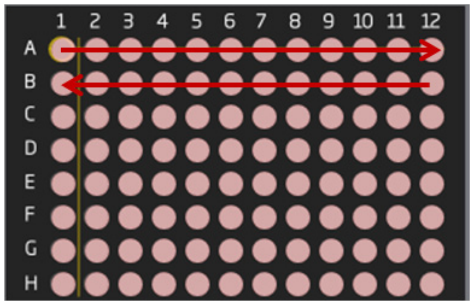
Auto Focus Toggle button is used during the monitoring.

It activates auto focus between **wells**. Select the number of how many wells to skip from the current well. Set the number based on well. According to the number, auto focus will be activated on wells which the user wanted.

In case of both **Manual Focus and Auto Focus turned on**, positions that set focus function (Page.27) applied move to the corresponding coordinate value. But positions that didn't applied set focus function, auto focus will be activated.

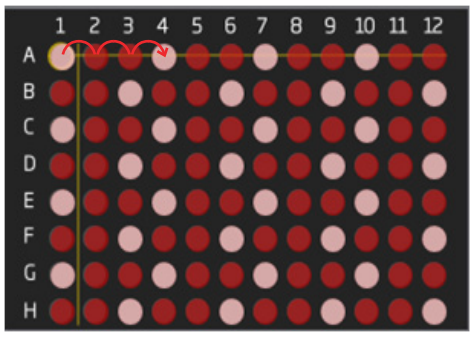
☞ *Note: You can select both of the Manual focus and Auto focus button at the same time.*

Examples



☞ *Note: Arrow indicates direction of progress.*

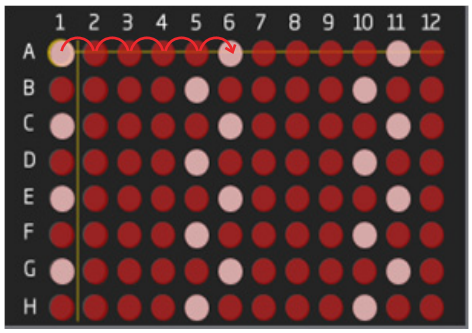
When you set **1** in Auto Focus, activate auto focus on wells with **skipping 1 well**.
⇒ So, the whole wells will activate auto focus.



When you set **3** in Auto Focus, activate auto focus on wells with **skipping 3 wells**.
⇒ So, only the white colored wells will activate auto focus.

Basic operation

Auto Focus



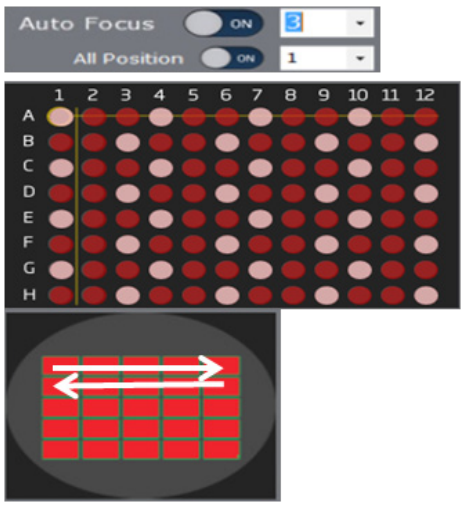
When you set **5** in Auto Focus, activate auto focus on wells with **skipping 5 wells**.
⇒ So, only the while colored wells will activate auto focus.

Auto Focus All Position

All Position Toggle button activates auto focus between **positions**. Select the number of how many positions to skip form the current position. Set the number based on location and number of positions in well. According to the number, auto focus will be activated on positions which the user wanted.

In case of **All Position turned off**, auto focus will be activated in the first position of well.

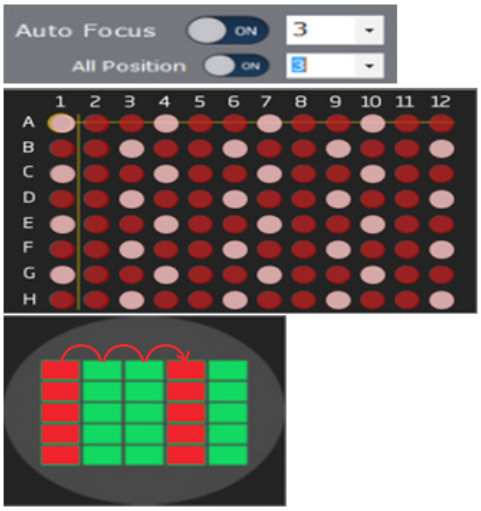
Examples



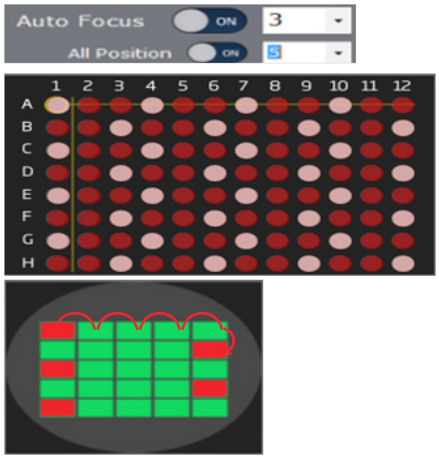
When you set **1** in All Position, activate auto focus on positions with **skipping 1 position**.
⇒ So, the whole positions will activate auto focus.

Basic operation

Auto Focus
All Position



When you set **3** in All Position, activate auto focus on positions with **skipping 3 positions**.
⇒ So, only the red square positions will activate auto focus.

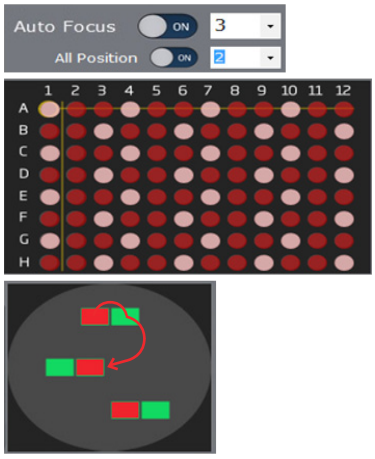


When you set **5** in All Position, activate auto focus on positions with **skipping 5 positions**.
⇒ So, only the red square positions will activate auto focus.

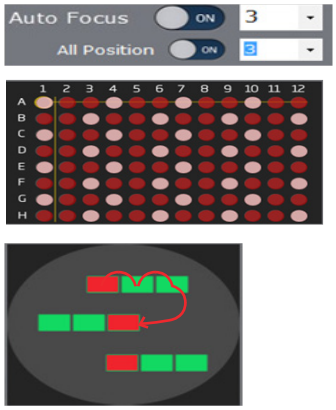
Basic operation

Auto Focus
All Position

Tip: When you set the positions with leaving space, right next to the positions are adjacent focus area. Therefore, activate auto focus only at the one position and save your time.



There are 6 positions. If you set **2** in All Position, only the 3 red square positions will activate auto focus.
⇒ So, it can be seen as you did auto focus on all of the 6 positions with just 3 auto focused positions.



There are 9 positions. If you set **3** in All Position, only the 3 red square positions will activate auto focus.
⇒ So, it can be seen as you did auto focus on all of the 9 positions with just 3 auto focused positions

Basic operation

Auto Focus
All Channel

All Channel Toggle button activates auto focus in **all channels**.

It basically activates auto focus on Bright channel. When you turn on All Channel, auto focus will also activate the GFP/RFP/DAPI channel as per Auto Focus and All Position setting that user specified.

☞ *Note: When All Channel turned on, Custom AF is not activated.*

Custom AF

Custom AF Toggle button is used to **revise the focus** if the auto-focus function does not provide optimal focus results corresponding to your sample. This is more convenient to operate in comparison with manual focus function.

This allows a user to set specific range of revision when there are the differences among channels.

Set the offset value in each channel from the Bright auto focus. Then move as much as user's setting and capture.

Basic operation

Auto Focus
Custom AF

Steps are as below.

1. Adjust the focus according to your sample, and then press the **Custom AF button** (When the autofocus mode is **turned on**).

2. The JuLI™ Stage Software automatically adjusts the **Optimal focus** corresponding to your sample in the bright field.

3. If necessary, edit the focus using the **Auto focus button** and then press the **Set button** to confirm. (The JuLI™ Stage automatically has memory for value; distance between auto-focused and a user moved position).

4. Select the channel using the **LED channel bar.**

5. Edit the focus following step 3 and then press the **Set button.** The z-value will be displayed.

6. If necessary, follow step 4 ~ 5 in different LED channel.

☞ *Note: Custom AF may not provide optimal focus when sample is damaged.*
☞ *Note: When Custom AF turned on, All Channel is not activated.*

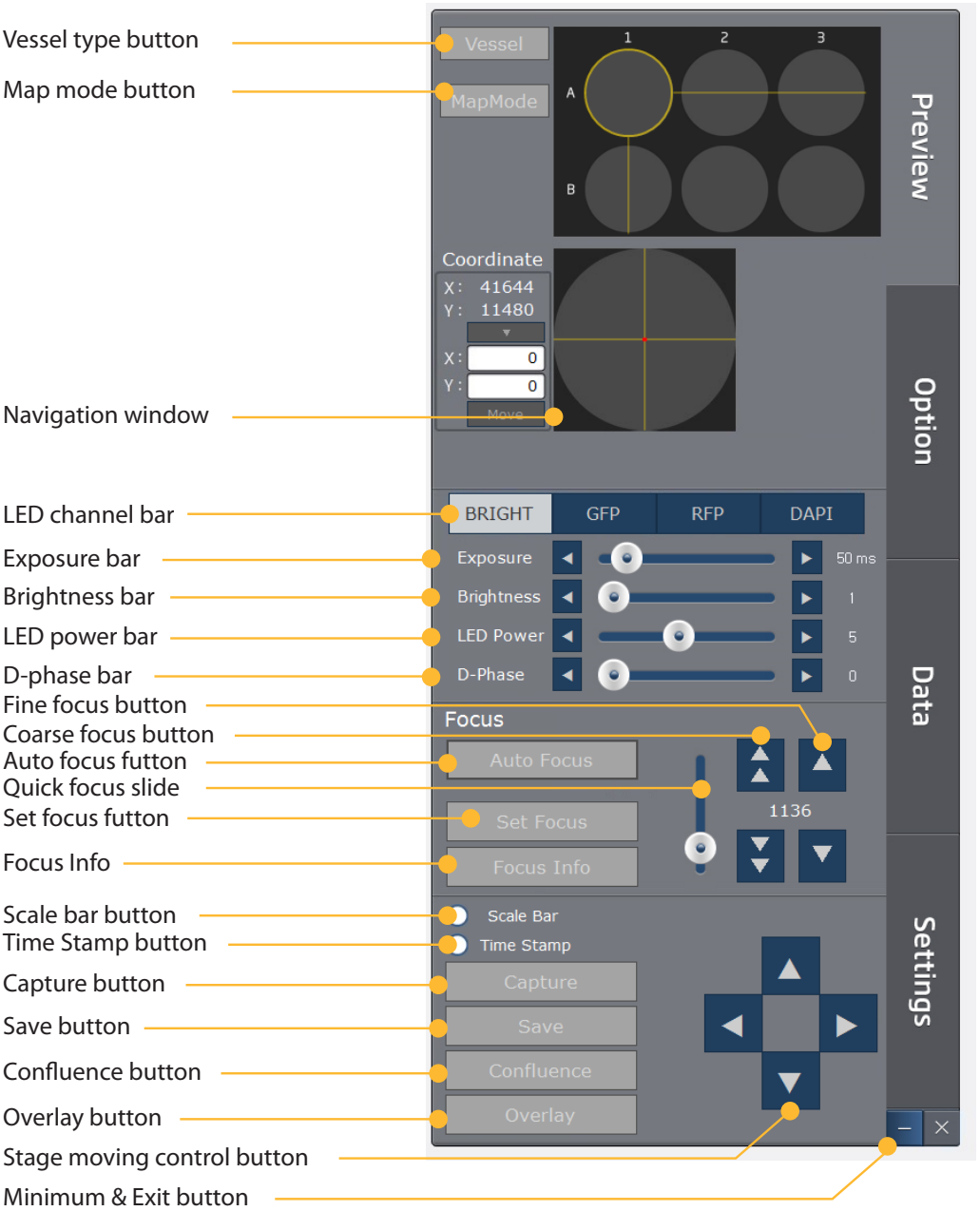
All Cycle AF

Press All Cycle AF button to auto focusing **in every cycle**. It helps auto focus to be located in right place that reflects change in every cycle.

Operation

Preview menu

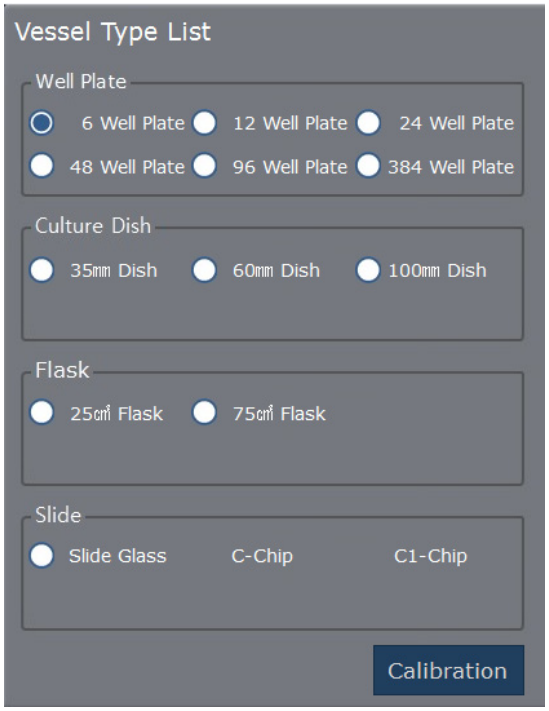
The **Preview menu** allows you to select basic system functions and is the first screen after start-up. It is available for checking the sample, setting the optimized focusing, capturing and merging the images.



Operation

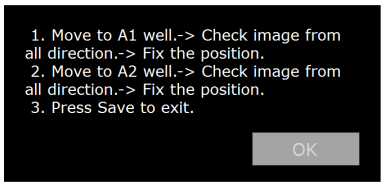
Preview menu
Vessel type

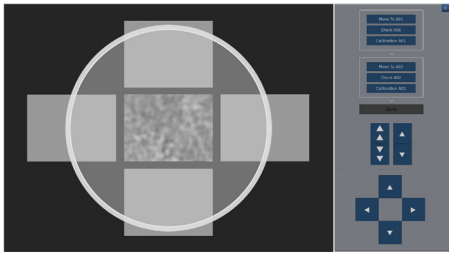
1. Press the **Vessel button**.
2. Select the **Vessel type,** which is used for selecting the sample vessel category.
3. Press the **Vessel button** again to close the window without calibration.

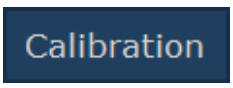


Vessel calibration

1. Press the **Calibration button**, if necessary.
2. Set the calibration options from up to bottom.
   Step 1) Move to A1 and check the A1. Set the calibration options by checking the up and down/ bilateral symmetry.
   Step 2) Move to A2 and check the A2. Set the calibration options by checking the up and down/ bilateral symmetry.
3. Press the **Close button** to exit.


1. Move to A1 well.-> Check image from all direction.-> Fix the position.
2. Move to A2 well.-> Check image from all direction.-> Fix the position.
3. Press Save to exit.
OK



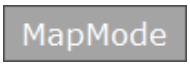


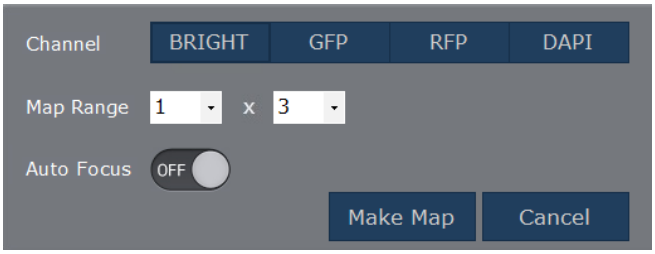
☞ *Note: Calibration function is only applied to well plate type. The Calibration button will be deacti vated on other types.*

Operation

Preview menu
Map mode

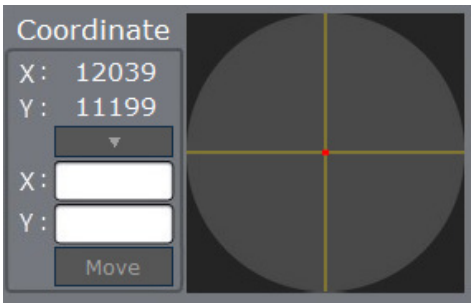
1. Press the **Map mode button**.
2. Press the **Map option button** which will appear after pressing the **Map mode button**.
3. Select the LED channel, map range which is free to choose (1 X 1 ~ 10 X 10), and check whether or not to use auto focus function.
4. Press the **Make a Map button**.
5. Press the **Cancel button** to return to previous screen without setting.
6. **Load map button** will be activated after finishing the map making.
7. Refer to Quick guideline for more details (page 45).





Coordinate

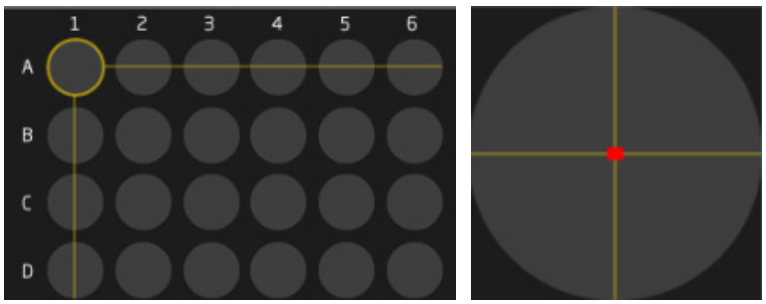
Identify current X-Y coordinate value or set and move to desired stage value.



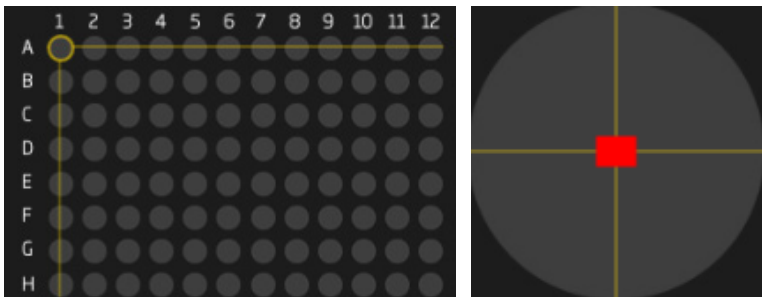
Navigation window

1. Preview well is marked by a **Yellow circle.**
2. The field you selected is marked by the **Red square** in the Navigation step.

☞ *Note: The size of red square, which is field of view, depends on vessel type.*



24 well plate



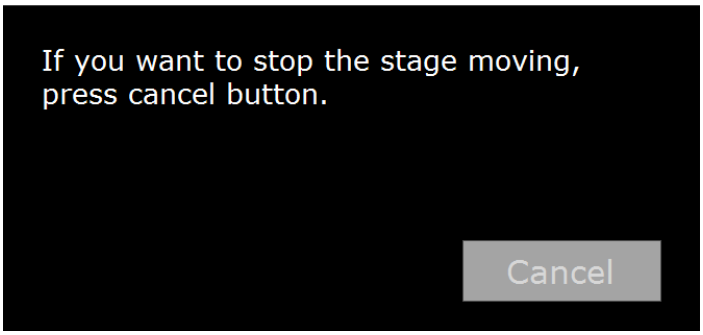
96 well plate

Operation

Preview menu

Navigation window

☞ *Note: When moving between wells, a popup message will be appeared to stop the stage moving. If you click the Cancel button, it will immediately stop at the current position*



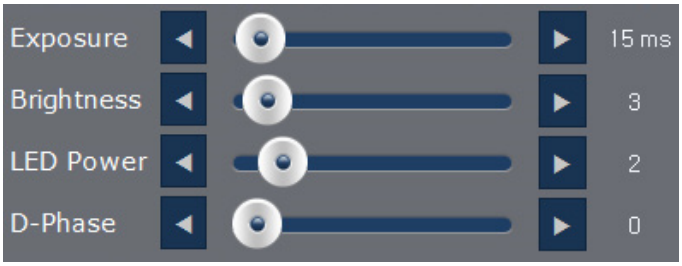
LED channel

1. Select one of the **LED channels** which will be applied in the preview.
2. Click other buttons to change LED channel, if necessary.
3. Click the button you selected once more to turn off.

Camera set

Camera setting allows users to customize the user interface within the range of setting values. To adjust the illumination intensity, use the Exposure and Brightness bar. To adjust the power of light sources, use the LED power bar. To observe in stereoscopic, use the D-Phase bar.

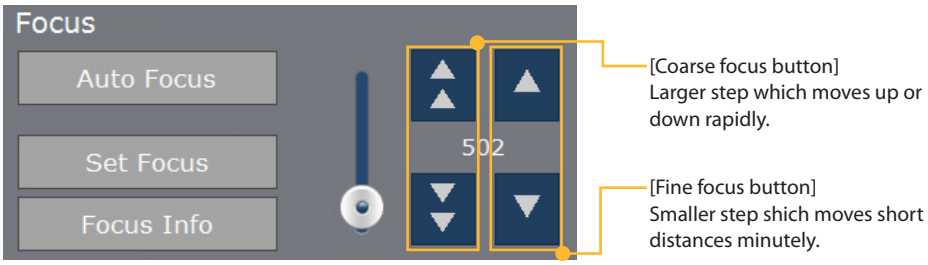
- Exposure range : 5 ms ~ 500 ms
- Brightness range : 0 ~ 40
- LED power range : 1 ~ 10
- D-Phase : 0 ~ 10



Focus

Focus menu is used for finding the position of sample easily and supports both Auto and Manual Focus.

1. Quick focus slide: Click to use quick investigation function.
2. Adjust the focus using the **Coarse** and **Fine focus button.**



☞ *Note: **Scroll up or down** with **Shift key** on the keyboard for fine focus adjustment.*

Operation

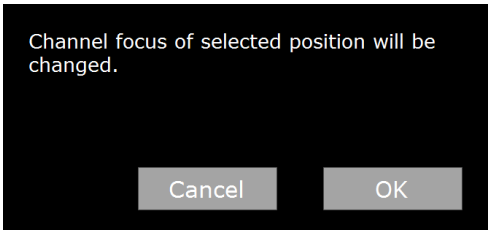
Preview menu

Auto focus

Press the **Auto Focus button** after checking the contours of cells which appeared.

Set Focus

1. Adjust the best focus by pressing the **Auto Focus button.**
2. Press the **Set Focus button.**
3. Press the **OK button** when the pop-up window appears.
4. Check the information about channel focus setting by the **Focus button.**



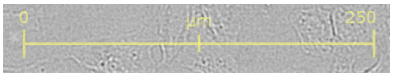
☞ *Note: The optimal focusing position is suggested by the JuLI™ Stage Auto Software. Set focus is also available if the suggested focusing position is not optimal.*

Focus information

1. Press the **Focus information button.**
2. The focus information button is designed to provide the focus setting information about each well.
   e.g. A1: Complete Bright focus
   A2: Complete Bright and GFP focus
   A3: Complete Bright, GFP and RFP focus

Scale Bar

Press the **Scale Bar** button to mark the Scale Bar on capture image.

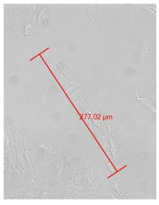


Time Stamp

Press the **Time Stamp button** to mark the Time Stamp on capture image.

Cell Size

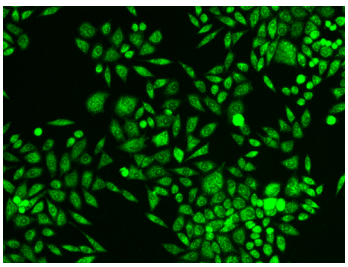
After capturing image, press the **mouse wheel** to mark the cell size on capture image.

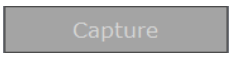


Operation

Preview menu
Capture image

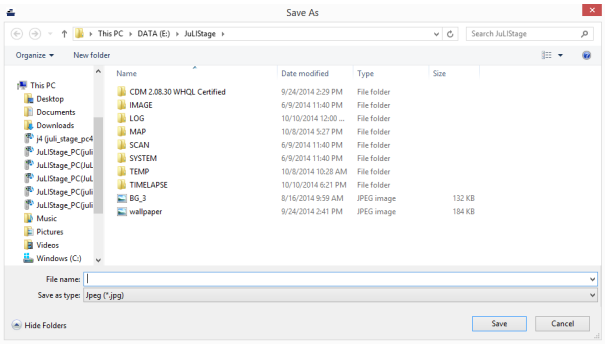
Press the **Capture button** to capture the image.





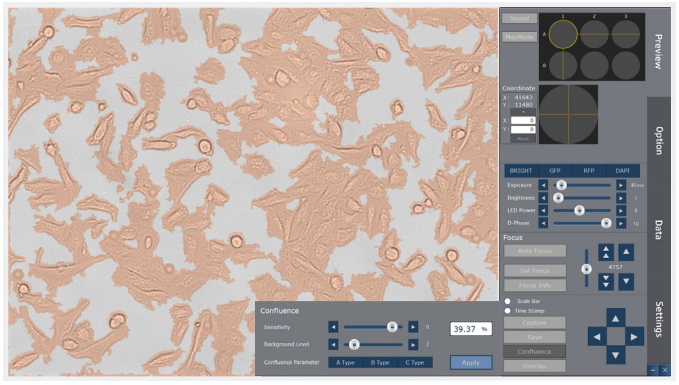
Save image

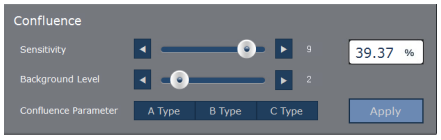
Press the **Save button** to save the **captured image.**
Enter the file name and store the path when the pop-up window appears.



Confluence

Press the **Confluence button** to check the confluence value in the bright field. The JuLI™ Stage supports two kinds of parameters (**Sensitivity, Background level**) which users are able to choose from A ~ C type.



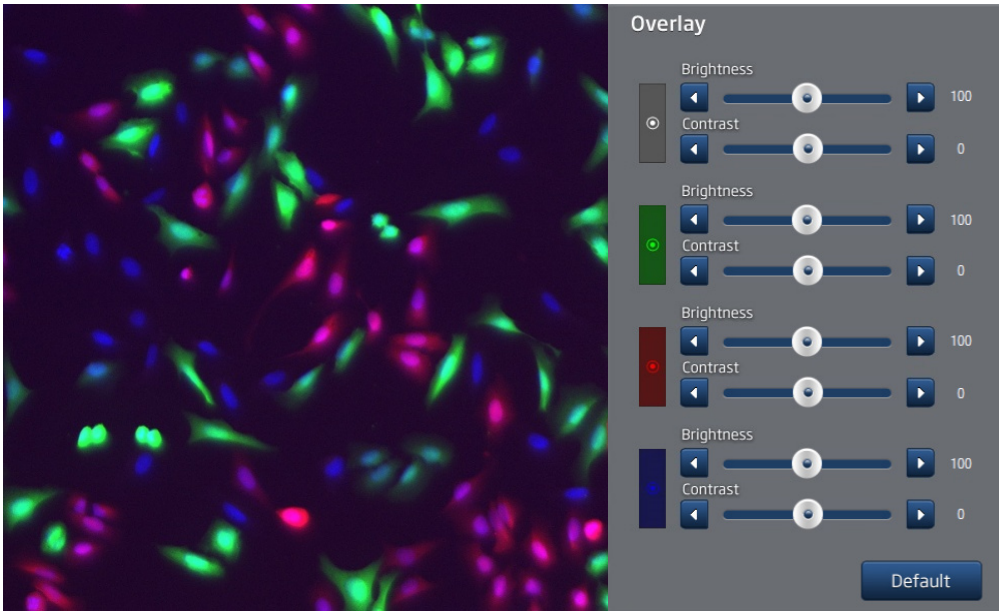


Parameter	Cell line	Recommendation
A(Default)	HepG2, GH3, Hep3B, A549, MCF7, SH-SY5Y, SCN2.2, NIH-3T3, F9, HeLa, DU-145	Sensitivity level 9 Background level 2
B	LNCaP	Sensitivity level 10 Background level 2
C	U-2 OS ADSC	Sensitivity level 10 Background level 8

Operation

Preview menu
Overlay image

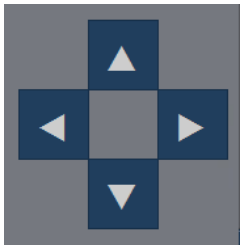
1. Capture images from **more than two channels**. (Bright, GFP, RFP or DAPI).
2. Press the **Overlay button**, then the editing window will appear.
3. Press the **Save button** in the overlay window to save the overlapped image.



Capture ▷ Overlay ▷ Save

Stage moving control

Press the **Stage moving control button** to control the X-Y stage position.



☞ *Note: The stage is also moved to the spot you assigned in the view field by **Dragging with right button of the mouse**.*

Minimum & Exit button

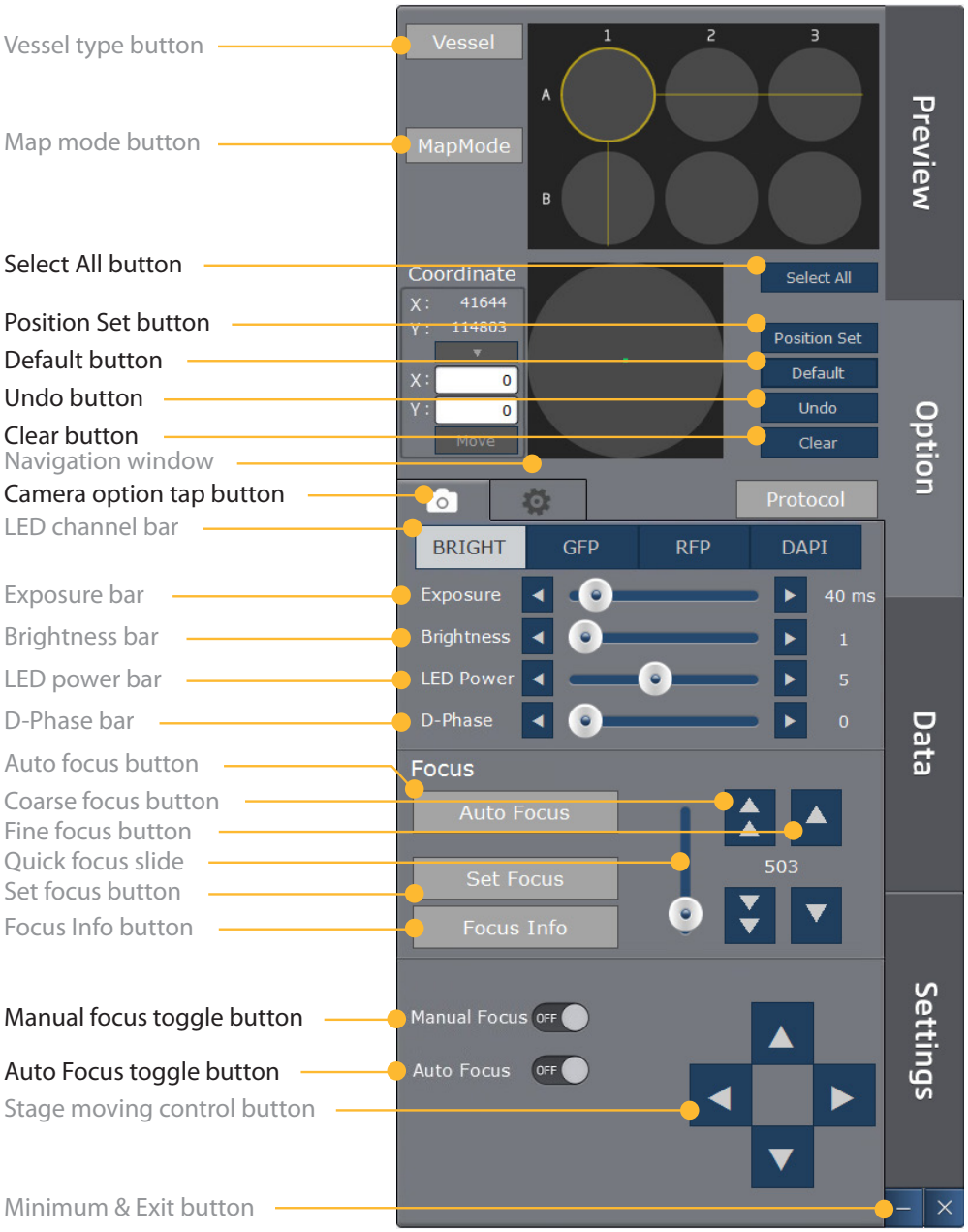
Minimize window or close the operation program using the **Minimize** and the **Close button.**

Operation

Option menu Camera setting option

The **Option menu** allows you to set the sample monitoring options. It is composed of two parts (**Camera setting and Monitoring setting option**).
Camera set part contains detailed functions such as assigning well/specific position, camera setting and focus settings (auto focus, point to focus and manual focus).

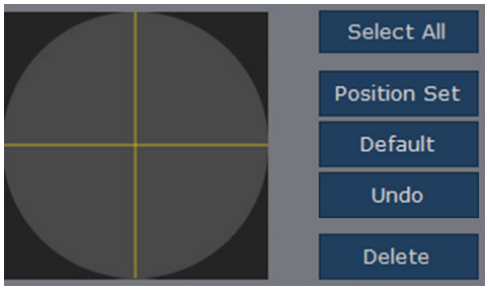
☞ *Note: The functions and buttons commonly used in **Preview menu**, Please refer to the details in Preview menu section.*



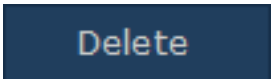
Operation

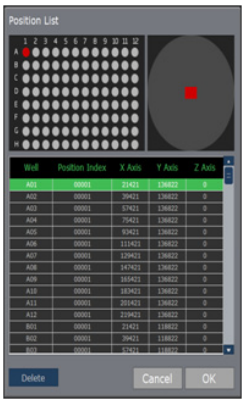
Option menu
Navigation position set

- **Select All** : Press **Select All button** to select all wells.
- **Position set** : Once **Position set button** is pressed after assigning an area you want, the area will be changed into **Red square** at navigation window.
- **Default button** : Select well and then press **Default button**, center value of well will be assigned. If you want to assign the area, press the **Position Set button.**
- **Undo button** : When you want to **Cancel the specified location** with the **Right Mouse button,** specified locations are cancelled chronologically from the most recent specified location.

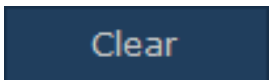


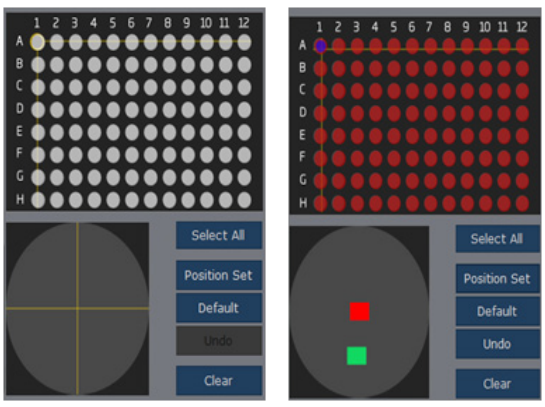
- **Delete button** : Press **Delete button** when you want to delete each selected position. This button will be displayed at normal times.





- **Clear button** : Press **Clear button** to delete all of the set value. This button will be displayed when you select well or position in temporarily.



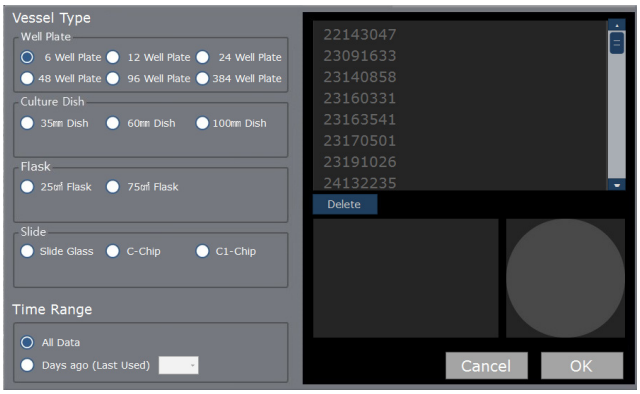


Operation

Option menu
Protocol

Press **Protocol button** to import the saved X, Y coordinate value.

- **Vessel Type** : Select **Vessel type.**
- **Time Range** : Select **All Data** to find data from the whole days.
  Select **Days ago (Last Used)** to classify recent data.
- **Delete button** : Click **Delete button** to remove data.

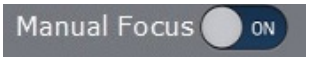


Camera
option tap

Press the **Camera Tap button** to select the option.

Manual Focus

Manual Focus Toggle button is used during the monitoring.
If there is Z value of a set position, move the Z coordinate and locate.



Operation

Option menu
Auto Focus

All of the functions listed below make users can do specific auto focus on well and position which they want.

1. **Auto Focus**: This function is based on auto focusing between wells. Skip wells as the set (a)number and activate auto focus.

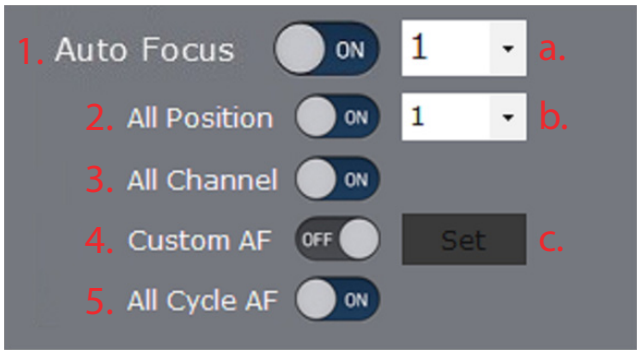
2. **All Position**: This function is based on auto focusing between positions. Activate auto focus in positions of wells as per Auto Focus setting. Skip positions as the set (b)number and activate auto focus.

3. **All Channel**: Activate auto focus in positions of all channels as per Auto Focus and All Position setting.

4. **Custom AF**: Adjust auto focus with setting the offset value of each channel from the auto focused standard value in the Bright channel.

5. **All Cycle AF**: Activate auto focus in every cycle.

☞ *Note: Auto Focus, All Position, All Channel, Custom AF and All Cycle AF options are only activated when the Auto Focus button turned on.*



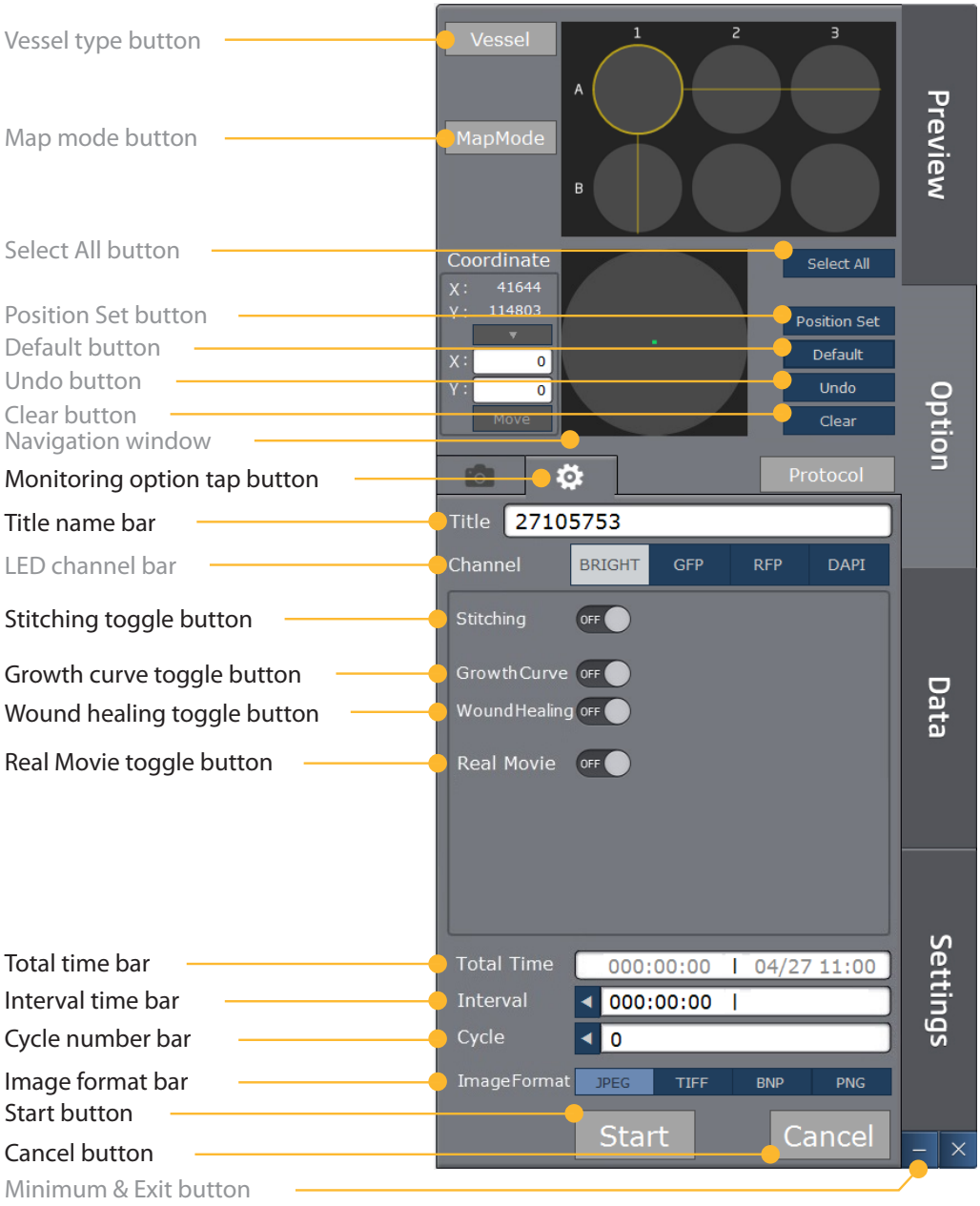
☞ *Note: Please refer to the Auto Focus guide on page. 23~28 or for more details.*

Operation

Option menu Monitoring Setting option

Monitoring set part provides various setting functions to **assigning tile**, setting detailed **monitoring condition** (interval and cycle) and setting **image format.**

☞ *Note: The functions and buttons commonly used in **Preview menu**, Please refer to the details in Preview menu section.*



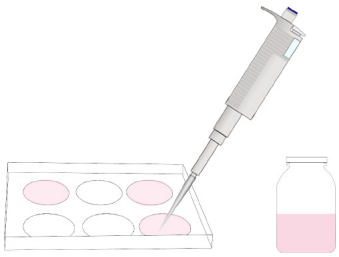
Operation

Option menu
Monitoring option tap

Move among options using the **Setting Tap.**

⚠ ***IMPORTANT!***

Warm up the JuLI™ Stage for 2 hours before monitoring.
The power should be on when warming up the instrument.

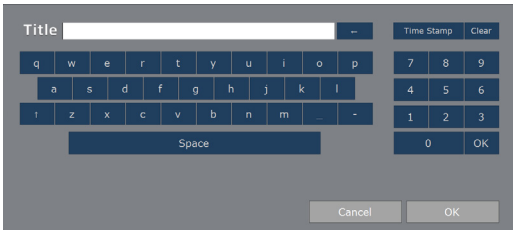


The well plate's cover should be wetted by the cell culture media before monitoring.
This step is required to avoid condensation inside the well plate cover for monitoring.

The 15 minutes of time interval is recommended to prevent from cell damage.
The cell may be damaged by LED less than 15 minutes interval in the case of monitoring in Bright & GFP mode. However, the optimal time interval depends on cell lines.

Title name

To start monitoring, assign the title using the pop-up keyboard.



LED channel

Select the channel using the **LED channel bar.**

Stitching option

Press the **Stitching toggle button** to apply stitching while monitoring.
Set the **Range of stitching** which is free to choose (1 X 1 ~ 10 X 10, 4 ~ 100 images).

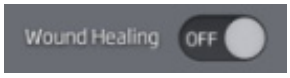
Growth curve option

Press the **Growth curve toggle button** to make growth curve while monitoring.
The growth curve can be recalculated when editing data. To make the growth curve, set the confluence parameters in the camera set part (Refer to page 30).

Operation

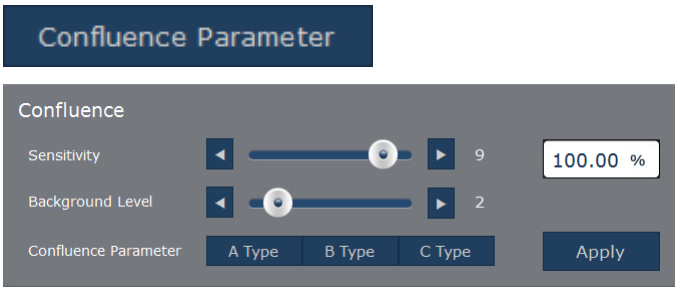
Option menu
Wound healing option

Press the **Wound healing** toggle button to make wound healing curve.
The wound healing curve can be recalculated when editing data.
To make the growth curve, set the confluence parameters in the camera set part (Refer to page 28).



Confluence parameter

Once **Confluence parameter button** is selected, the setting window will be shown up. After parameter is modified, press the **Apply button** to see image



Real Moive

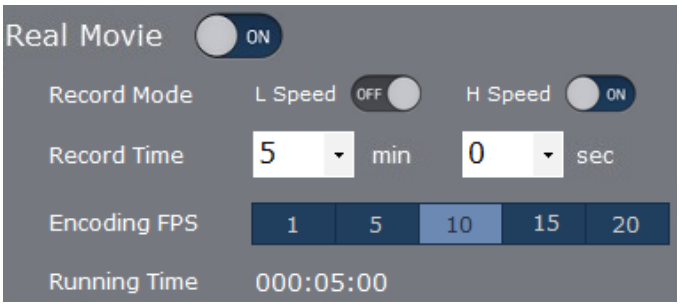
Create **real time movie**. The video is created to **AVI file** format.

- **Record Mode** : Select how many frames will be take in a second.
  Press **L Speed** to take 5 frames in a second. (1,936 x 1,456 pixels)
  Press **H Speed** to take 10 frames in a second. (968 x 728 pixels)

- **Record Time** : Recording time can be set from **15 seconds (min) to 5 minutes (max)**.

- **Encoding FPS** : Select how to encoding the frames as a video.
  For example, if you select L Speed and 10 FPS, it takes 5 frames in a second and then 10 frames in 2 seconds are encoded to a 1 second video.

- **Running Time** : Show running time of the encoded video.

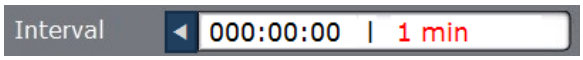


Operation

Option menu
Time set & Mode

- **Total time**: Is not modified at this window and is displaced by calculating of interval time and cycle with the end date and time.

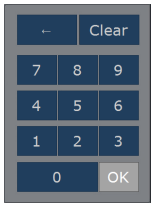
- **Interval time**: When a well is selected, **estimated time** shows up with red color depending on selected condition. With reference select interval time. The interval time can not be set shorter than the red estimated time.



- **Cycle**: Select number of image in each position.

☞ *Note: You can edit the monitoring cycle while monitoring by pressing **Pause button**.*
*The new cycle value that you will enter is **more than the current cycle**.*

When Each bar is double-clicked, the interval and cycle setting **key pad** shows up.



⚠ ***IMPORTANT!***

The 15 minutes of time interval is recommended to prevent from cell damage.
The cell may be damaged by LED less than 15 minutes interval in the case of monitoring in Bright & GFP mode. However, the optimal time interval depends on cell lines.

Image format

Image format can be saved as 4 types of file. One type of file can be selected at a time.

Operation

Option menu
Start button

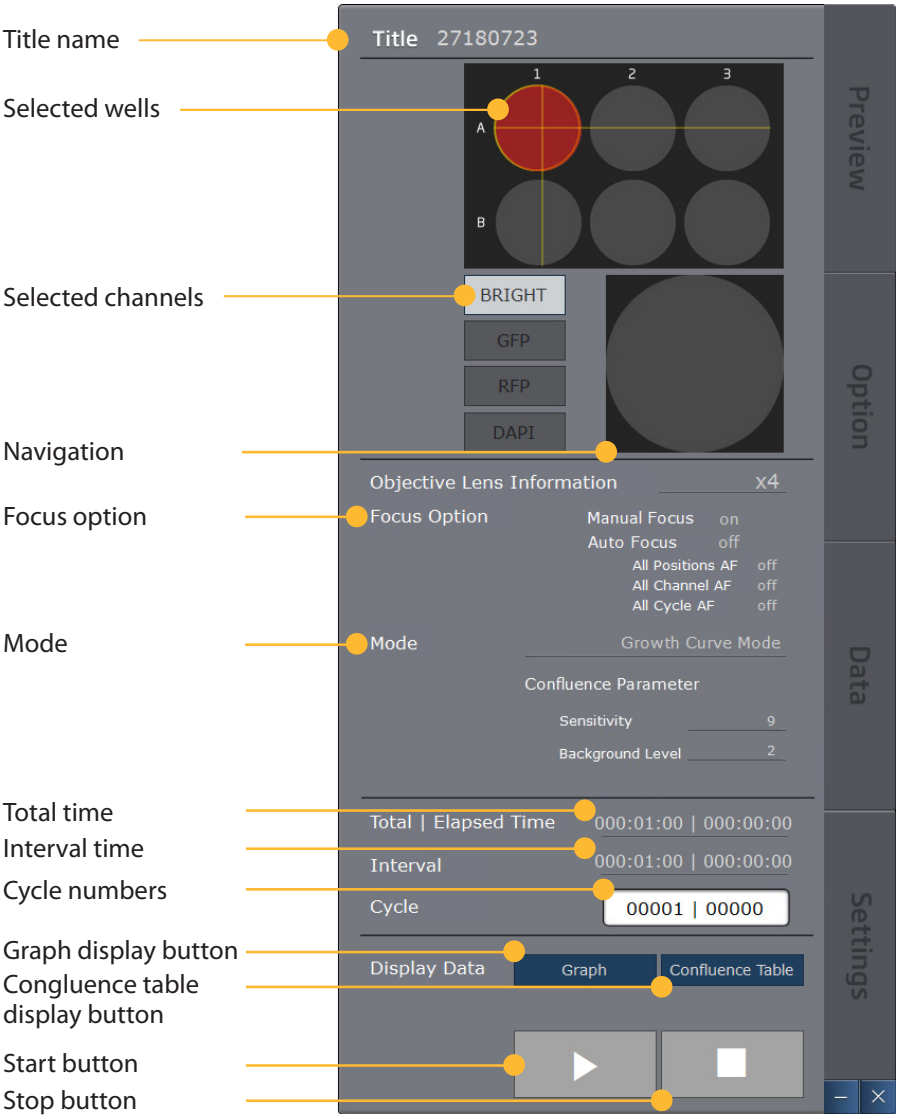
Press the **Start button** to move to the next step.

Cancel button

Press the **Cancel button** to reset.

Ready to start

Ready to start window shows all setting information you assigned.
Press the **Play button** to start program after checking the settings.



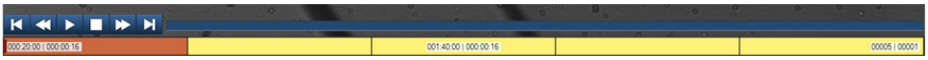
☞ *Note: You can edit the monitoring cycle while monitoring by pressing* ***Pause button.***
The new cycle value that you will enter is ***longer than the current cycle.***

Operation

Option menu
Process bar

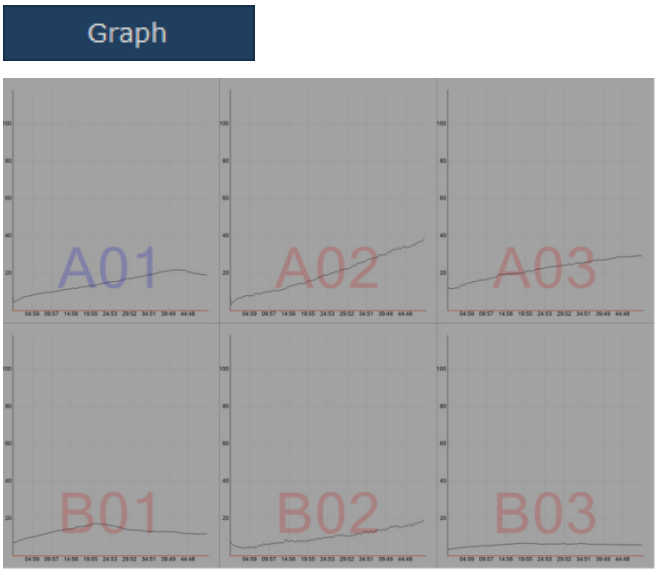
While capturing Time labs current filmed condition, completed image and others are expressed in **Process bar**.

Image and graph which captured at selecting past area are also displayed.



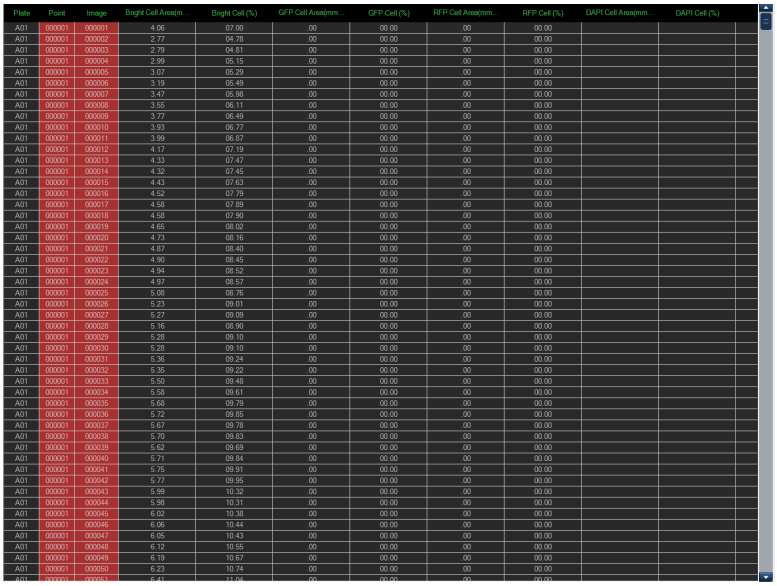
Graph data

The **Graph button** shows all graphs so far while the instrument is working.



Confluence table

The **Confluence Table button** provides back data sheet of Graph.

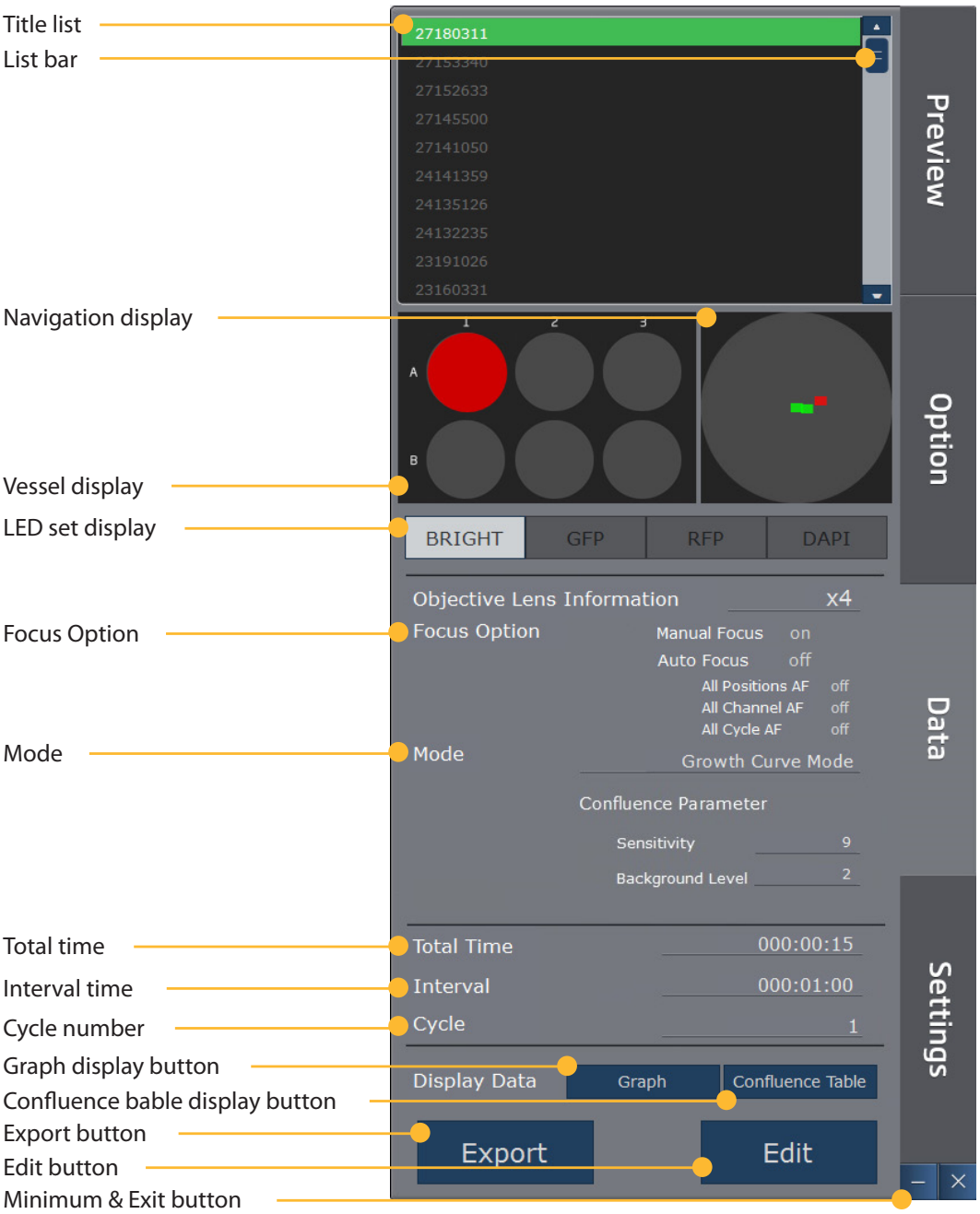


Operation

Data menu

Data menu provides the function to view and edit the captured images. In the data menu users are able to check, edit data (cell growth curve, wound healing) and make a movie.

Once you selected the title, the JuLI™ Stage shows test conditions including vessel type, well captured position, LED channel condition, interval time and cycle number.

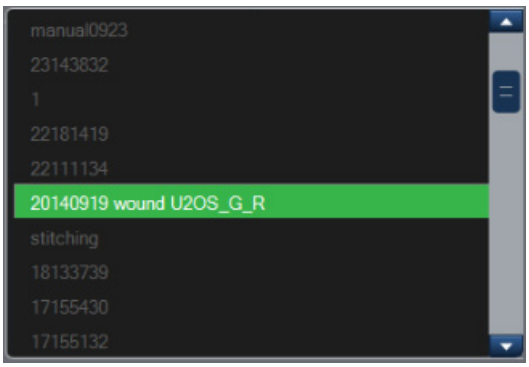


Operation

Data menu

Title list

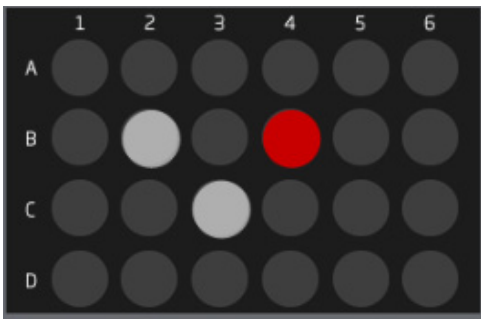
The selected title is marked by green color when clicking a title.



Vessel display

The color of vessel contains information about test conditions.

- Grey circles: Captured well
- Red circles: Captured well and selected for review



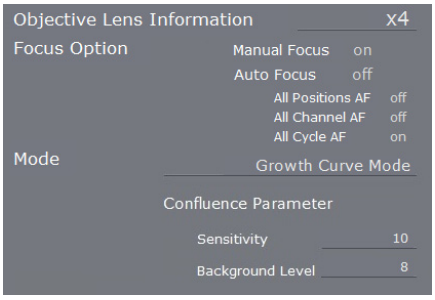
LED set & Navigation display

LED set & Navigation display contain the **condition of LED channel and position** of captured images. The JuLI™ Stage can hide or open information by pressing the **LED channel buttons.**

The captured position is marked by **Red square** as below. Click the red square to check the images in detail.

Experiment information

Display user's selected **Option and Information**.



Operation

Data menu
Time set & Mode

Time setting condition and the mode information are displayed

Display data

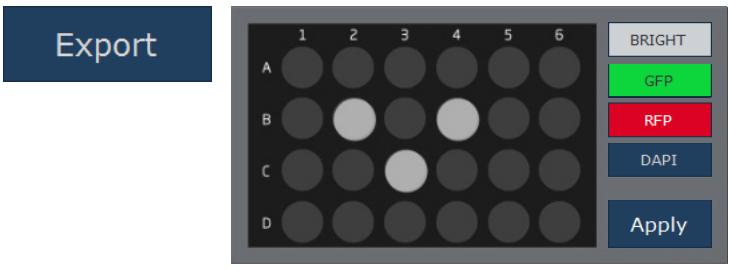
Press the **Display Data button** (**Graph and Confluence table**) to check growth curve and confluence data.

Display data contains the **Graph** and **Confluence table button** that open related information. For example, press the graph button to check the wound healing and growth curve.

☞ *Note: If the growth curve or the wound healing mode is not selected in option menu, the button may not be activated. If necessary to obtain growth curve data, you can edit confluence data table in Edit mode.*

Display export

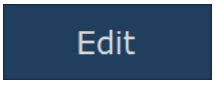
Press the **Export button** to export the captured images. The multiselection function is supported.



☞ *Note: Can access or download the image data through **JuLI™Stage / TIMELAPS folder** in PC also.*

Display edit

Press the **Edit button** to get additional analysis and data with test results.
(described in next page for more details)



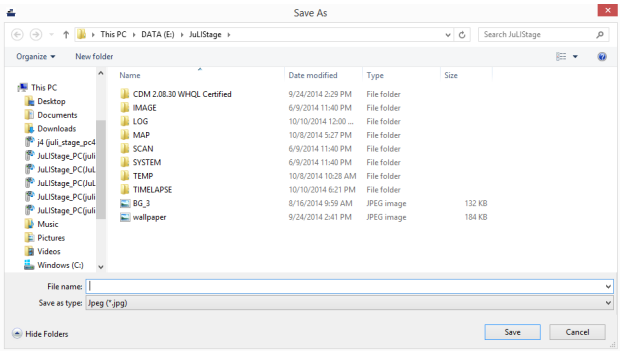
Operation

Data menu
Data edit

Edit operation allows users to get additional analysis and data with test results.
This Editing operation mode gives you excellent imaging function to **overlay image & movie and reset confluence parameter** for more accurate growth curve.

Overlay option

Edit the **parameters** in overlay tab of Edit menu according to your test condition.
Press the **Save button** and assign title and storing path.

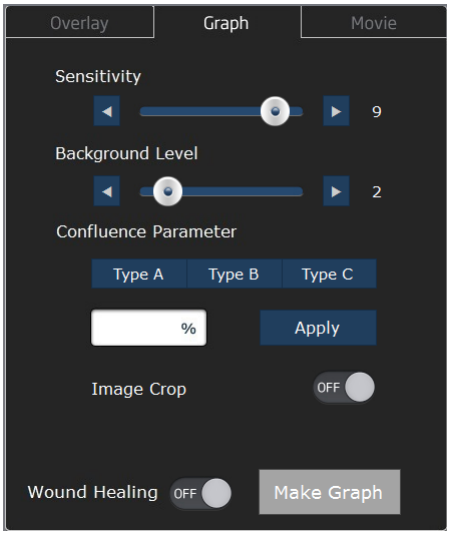


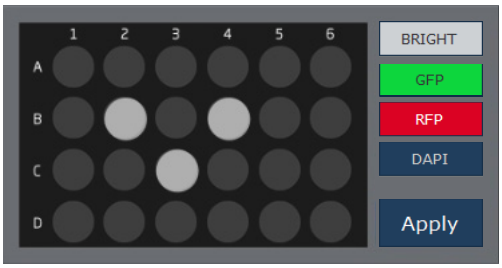
Operation

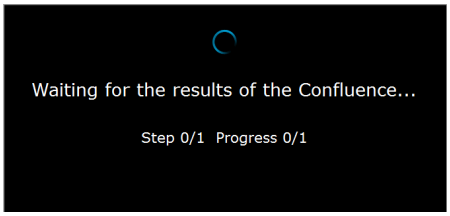
Data menu
Growth curve save as

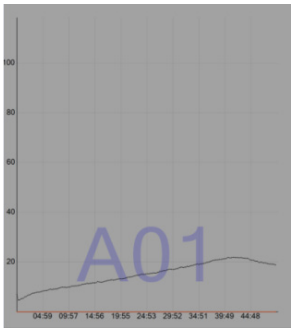
1. Select tile of existing data to make growth curve and click the **Edit button.**
2. Edit the **parameters** in the **Graph tap** to set the optimal condition for confluence.
3. Image Crop : Crop image to make graph of area that user wants.
4. Wound healing mode: Turn on the **wound healing toggle button**, if necessary.
5. Press the **Make a graph button** to check vessel images
6. Press Export button and select the **Well** and **LED channel** and Press the **Apply button.**

☞ *Note: User can save time of making graph with using Image Crop function.*







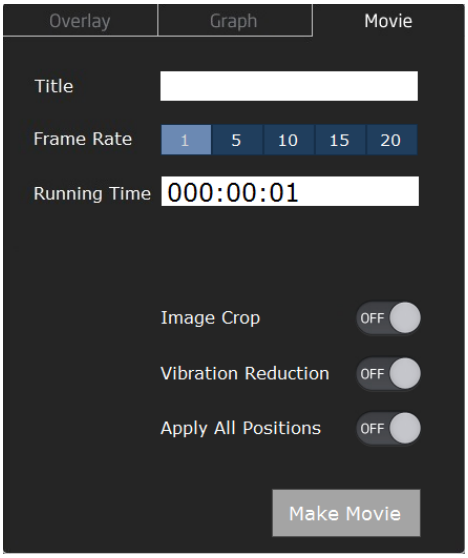


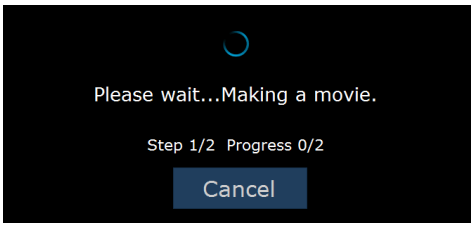
Operation

Data menu
Overlay movie save as

Edit the parameters in overlay tab of Edit menu and move to the **Movie tap.**

1. **Title**: Click the **Title bar** and type the title and storing path.
2. **Frame rate**: Choose one of the frame rates. (1, 5, 10, 15 or 20 fps)
3. **Running time**: Expected running time depends on numbers of images in folder and frame rate.
4. **Image Crop**: Crop image to make movie of area that user wants.
5. **Vibration Reduction**: Prevent vibration of movie.
6. **Apply All Positions**: Make movie of all positions
7. **Make movie** : Press the **Start button** to make a movie
8. **AVI file** will be created in storing path you assigned.

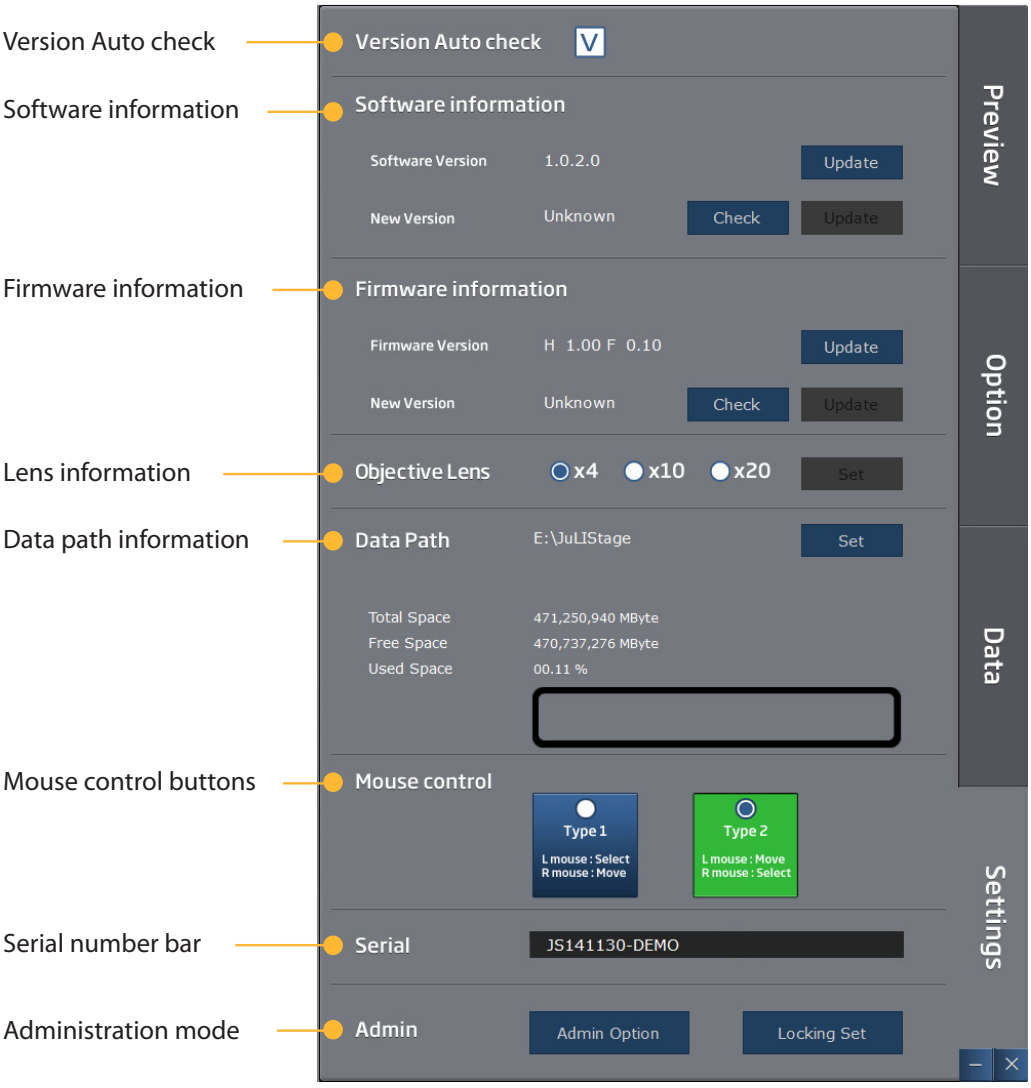




Operation

Setting menu

Setting menu contains information about the JuLI™ Stage as well as several user preference and other Settings. Setting menu allows users to edit settings about the software & firmware information and basic operations.



Operation

Setting menu

Version Auto check

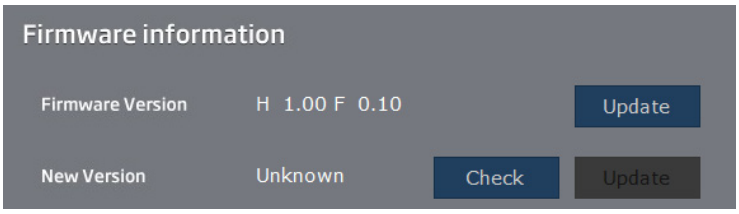
The JuLI™ Stage checks for **the latest version of software or firmware** and automatically display the information window whenever it starts up. This is available only for PC with **internet connection.**

Software information

Software information is used to **update** through the USB drive and network connection.

Firmware information

Firmware information is used to **update** through the USB drive and network connection.



☞ *Note: Press **Update button** if you have the update file for the software or firmware. Or press **Check button** and then **Update button** if the PC has a internet connection for updating.*

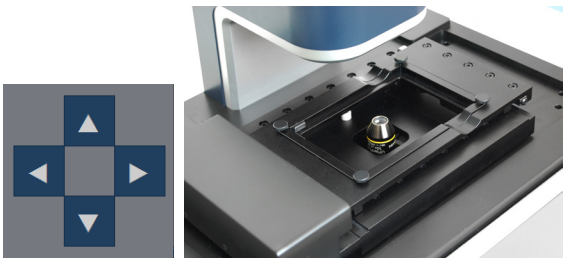
Objective Lens

Provides lens information when it moves and checks the size. The lens can be changed by hands and the size of field of view (square) on navigation window is also changeable as lens information.

Press **Set button** to make it can find fitted location with moving the X-Y stage automatically when users change Objective lens and fix locking module. Press **Set button** to fix the lens when you changed the lens.

Changing lens

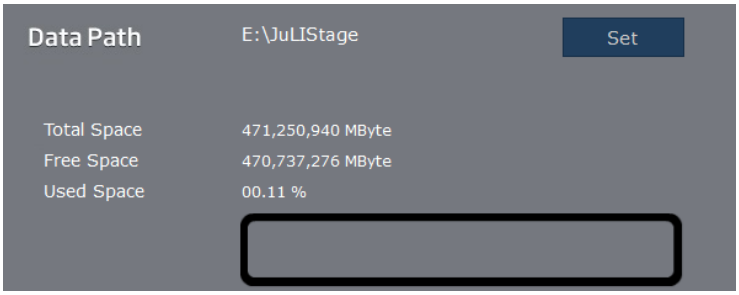
1. Move the X-Y stage to the center position using the Stage moving control button.
2. Loosen and rotate the current lens counterclockwise to remove it from the holder.
3. Place the new lens on the holder and rotate clockwise. Be sure to rotate the objective until it is tight in the holder.



Operation

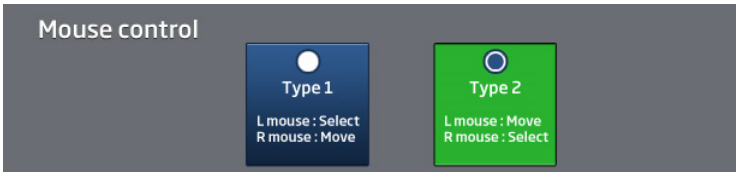
Setting menu
Data path & system info

Allows users to assign the save path and check disk volume



Mouse type

Mouse control is used for changing basic function of mouse.



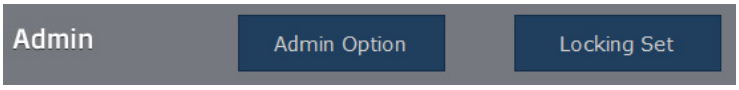
☞ *Note: Type 1 is factoring setting. Can change the type, if necessary.*

Serial info

Shows serial number of the JuLI™ Stage main instrument.

Admin mode

Administration mode. It is for manufacturing engineers to set the system.

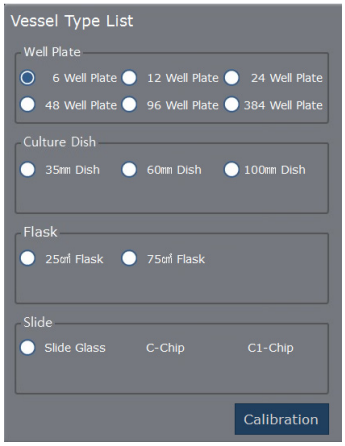


Quick operation guide (Image capture, save and overlay)

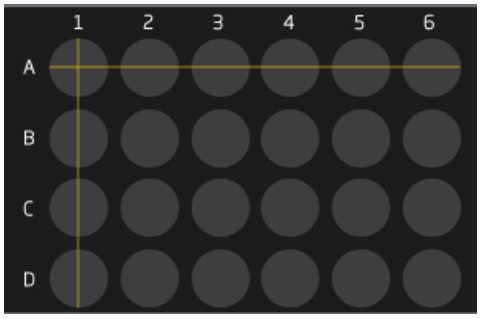
1. Select the **Preview menu.**

2. Press the **Vessel button.**

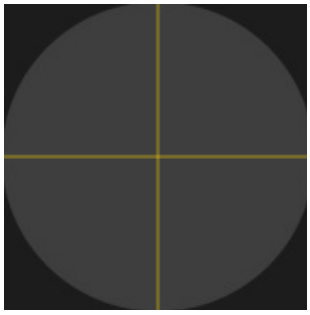
3. Select the Vessel type according to your sample **when well** type list appears.



4. Check the **Selected Vessel type** and press **Vessel button** again to finish setting

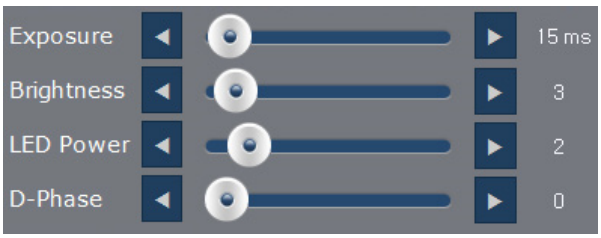


5. Move to the well and position you want using the right button of mouse. You can check the vessel image and the moving state in the navigation window and view field.

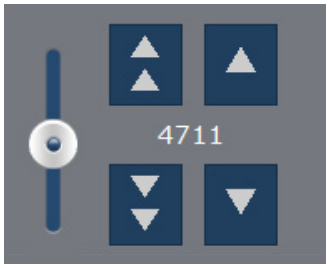


6. Select the **LED channel** for capturing images.

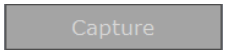
7. Adjust **Exposure**, **Brightness**, **LED Power and D-Phase**, if neccessary.



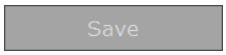
8. Find optional focus and adjust with **Focus bar and buttons**



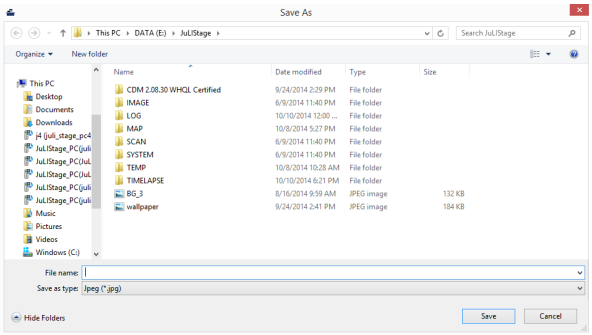
9. Press the **Capture button** to start capturing images.



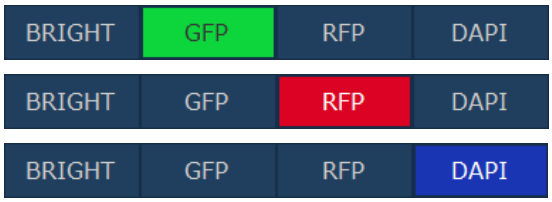
10. Press the **Save button** to save the captured images, if necessary.



11. Once pop-up window appears, assign the storing path and file type, and press the **Save button** to confirm.

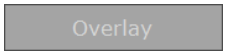


12. If necessary to capture additional images in different channel, select **other LED channel.**

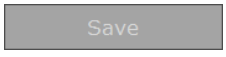


13. Follow Step 6 ~ 10 repeatedly and save images for each channel.

14. After pressing the **Overlay button**, the overlapped images, which captured in each channels, will be displayed.

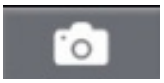


15. When Overlay button opens the Overlay setting window, edit parameters according to your preference. And then press the **Save button** to follow step 10 ~ 11(The images will be saved as).



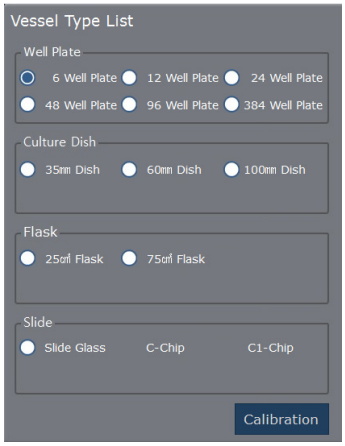
Quick operation guide
(Multi well default position and Auto focus)

1. Select the **Option menu** and the camera tap will be activated.

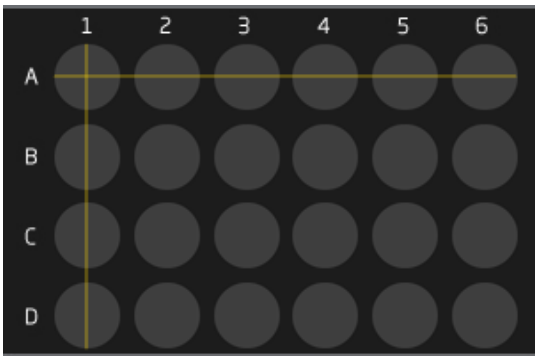


2. Activate the **Vessel button** by pressing.

3. After well type list appears, select the **vessel type** according to your sample.

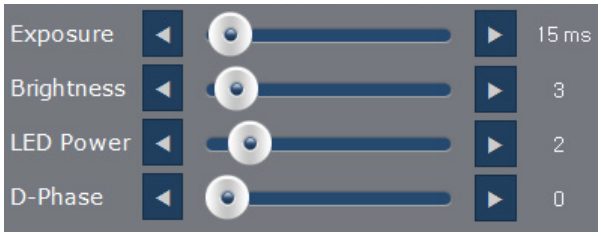


4. Check the **Selected Vessel type** and press **Vessel button** again to finish setting.

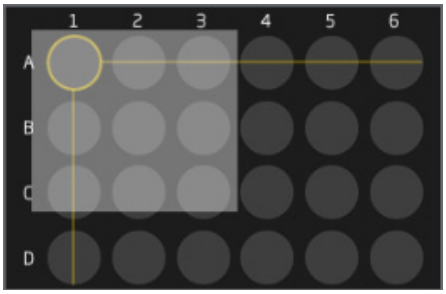


5. Select the **LED channel.**

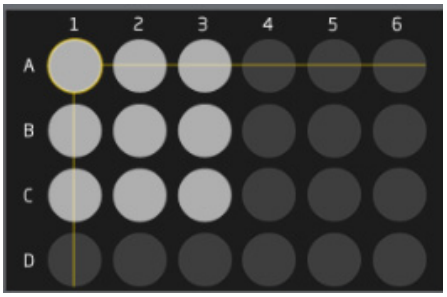
6. Adjust **Exposure**, **Brightness**, **LED Power and D-Phase**, in neccessary.



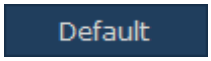
7. **Select areas** you want to capture by dragging with left mouse button.



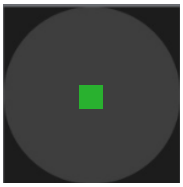
8. The selected wells are changed to **Grey color**.



9. Press the **Default button** to equally capture central position of all wells.

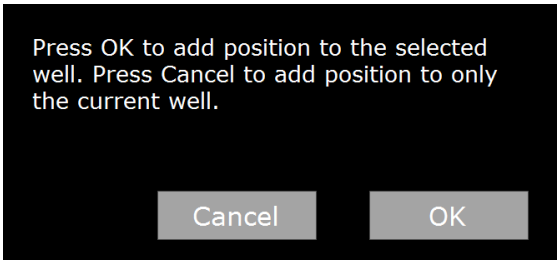


10. The assigned position is marked by green square on navigation window.

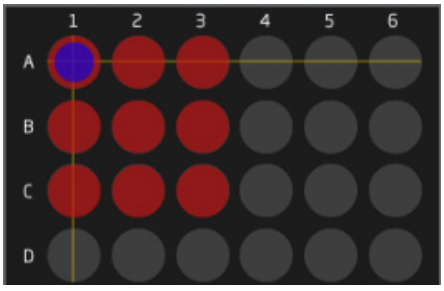


11. Press the **Position set button** to complete setting that the green square is changed to **Red**.

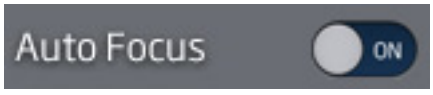
12. Press the **OK button** when pop-up window appears.



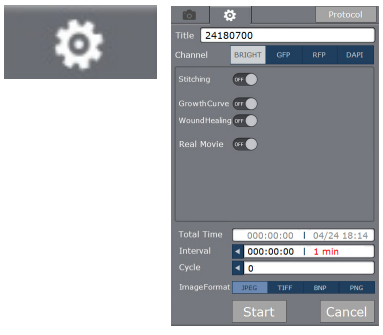
13. Once the wells are finally confirmed, they are changed to **Red color**.



14. Turn on the **Auto focus toggle button.**



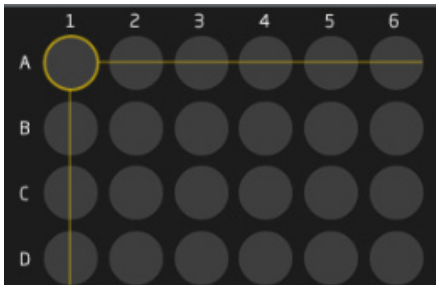
15. Select the **Setting icon** of Option tap.



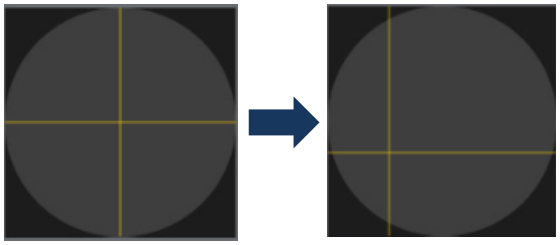
16. Refer to the detail options of **Monitoring option tap** in the **Option menu** (page. 40)

Quick operation guide (Manual position set and Manual focus)

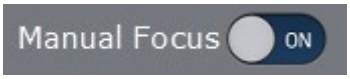
1. Click a well you want to capture using right mouse button.



2. Once the well is selected, the X-Y stage is automatically moved to center of well. Move to position you want using right mouse button, and check where you moved to within the navigation window.

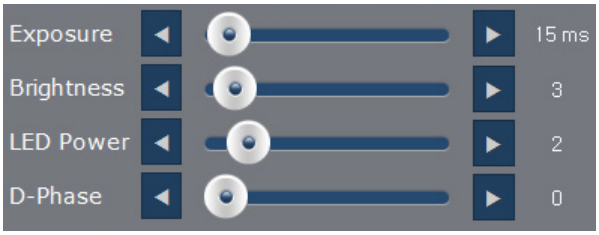


3. Press the **Manual focus toggle button.**

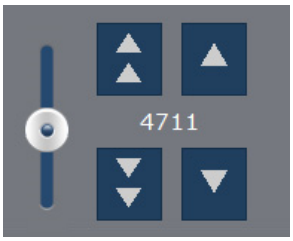


4. Select **LED channel**.

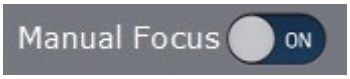
5. Adjust **Exposure**, **Brightness**, **LED Power and D-Phase**, if neccessary.



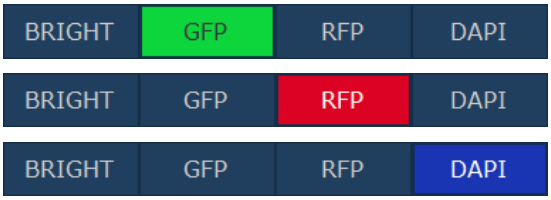
6. Find optional focus adjusting the **Focus bar and buttons.**



7. **Manual Focus button** is used to assign optional focus per each position. After setting the focus of each position, press, the **Manual Focus button** to save setting value.

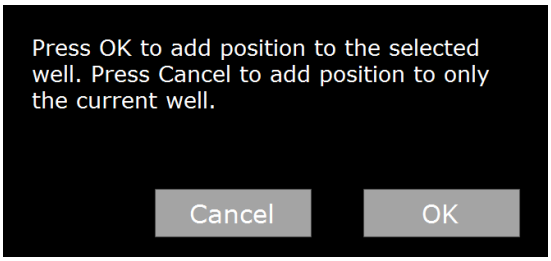


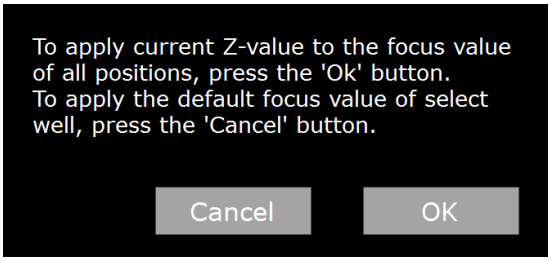
8. If necessary to set manual focus in other channel, press the LED button and follow previous step 4 ~ 7.



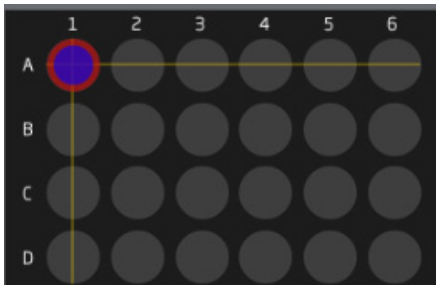
9. After adjusting focus and assigning position, press the **Position Set button.**

10. Press the **OK button** when the pop-up window appears.




To apply current Z-value to the focus value of all positions, press the 'Ok' button.
To apply the default focus value of select well, press the 'Cancel' button.
Cancel
OK

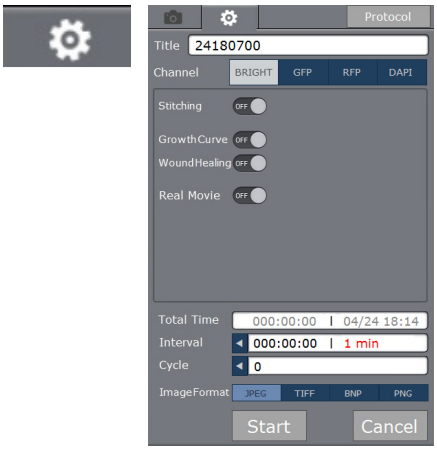
11. Once the wells are finally confirmed, they are changed to **Red color**.



12. If necessary to set manual focus in other well, follow the previous step 1 ~ 11.

13. Select the **Setting tap** of monitoring option.

14. Check detail options of **Monitoring option tap** in the **option menu** (page. 40)



Cleaning and Maintenance

Clean the surface of the JuLI™ Stag with a damp cloth. To clean the LCD screen, turn off the JuLI™ Stage, disconnect the power cable, and clean the LCD screen with a soft cloth lightly moistened with LCD cleansing detergent. Cleaning the screen with excessive force can damage the LCD screen.

If liquid spills on the JuLI™ Stage, turn off the power immediately and wipe dry.

The JuLI™ Stage™ does not need regular maintenance. To troubleshoot problems with the JuLI™ Stage™, contact Technical Support (Refer to page 67).

⚠ ***IMPORTANT!*** ***Never disassemble or service the JuLI™ Stage by yourself.***

Unauthorized repairs may damage the JuLI™ Stage or alter its functionality, which will void your warranty. Contact ***sales@nanoentek.com*** *or your local the JuLI™ Stage distributor to arrange for service.*

⚠ ***IMPORTANT!*** ***The JuLI™ Stage is optimized into standard size of cell culture incubator.***

It is recommend that the temperature should be stabilized in case of a small size incubator before using the instrument.

⚠ ***IMPORTANT!*** ***Warm up the JuLI™ Stage for 2 hours before monitoring.***

The power should be on when warming up the instrument.

⚠ ***IMPORTANT!*** ***The well plate's cover should be wetted by the cell culture media before monitoring.***

This step is required to avoid condensation inside the well plate cover for monitoring.

⚠ ***IMPORTANT!*** ***Avoid exposing the JuLI™ Stage to UV light.***

UV light may degrade components, including plastics. Damage from UV exposure is not covered under the manufacturer's warranty.

⚠ ***IMPORTANT!*** ***Always wipe surfaces with ethanol-soaked paper towels.***

Do not directly spray ethanol anywhere on the JuLI™ Stage.

Troubleshooting

Intstallation	
JuLI Stage does not power up	• Check on/off switch on back side of main device. • Check power source or contact your distributor.
LCD screen is black	• Move the mouse. • Check if power supply is connected and power switch is on. • Reset the power button.
Monitoring	
Poor image (Too dark and too bright)	• Re-optimize the brightness and exposure value. • Reset the power button
Dirty image	• Swipe the stage with cotton swab carefully. • Eliminate any dust on the culture dish. • Check for and remove any condensation on thelid of the culture dish.
Time-lapse images become dark or bright	• **Warm up the instrument for 2 hour before monitoring.** (power should be on when warming up the instrument) • **Cell culture flask should be wetted by the culture media before making a movie.** • Eliminate any dust on the culture dish. • Remove any condensation on the lid of the culture dish. • To prevent any problem such as shaking of culture dish or inflowing light, pay special attention when you open or close incubator door during monitoring.
Problem for saving movie file	• Check available volume of the hard disk.

Warranty

NanoEnTek provides 1-year warranty service for defects of material and workmanship.

If any defects occur in the JuLI™ Stage, NanoEnTek provides free repair service for the defective parts at its discretion.

The following defects, however, are specifically excluded:

1. Defects caused by improper operation.
2. Repair or modification done by anyone other than NanoEnTek or an authorized agent.
3. Damage caused by substituting alternative parts.
4. Use of fittings or spare parts supplied by anyone other than NanoEnTek.
5. Damage caused by accident or misuse.
6. Damage caused by disaster.
7. Corrosion caused by improper solvent or sample.

For your protection, the JuLI™ Stage units being returned must be insured against possible damage or loss. NanoEnTek cannot be responsible for damage incurred during shipment
of a defective instrument. It is recommend that you save the original packing material in which the instrument was shipped. This warranty is limited to the replacement of defective products.

For any inquiry or request for repair service, contact **sales@nanoentek.com** or your local distributor.

Safety precautions

Review and follow the safety instructions below :

- If water or other material enters the instrument, adaptor, or power inlet, disconnect the power cord and contact a service person. For operating environment, refer to Product Specifications.
- Do not touch the main plug or power cord with wet hands.
- Always ensure that the power supply input voltage matches the voltage available at your location.
- This instrument is air-cooled and its surfaces may become hot during operation.
  During installing, leave a space of more than 10 cm (4 inches) around the instrument and do not place any objects between the instrument and the walls.
- Do not install the instrument on a slant or a place prone to vibrations, which induces he risk of instrument malfunction or damage of the instrument.
- Never insert any objects into the air vents of the instrument as this could result in electrical shock, personal injury, and equipment damage.
- Plug the power cord firmly into the wall outlet and AC adapter.
- To avoid potential shock hazard, make sure that the power cord is properly grounded.
- Be sure to position the equipment such that it is easy to disconnect.
- Turn off the instrument before unplugging the power cord and/or moving the instrument.
- If the instrument is dropped or broken, disconnect the power cord and contact a service person.
  Disassembly of case will void warranty.
- Use only authorized accessories (adaptor, power cord, and USB drive).

⚠ Warning

Class A equipment is intended for use in an industrial environment. In the documentation for the user, a statement shall be included drawing attention to the fact that there may be potential difficulties in ensuring electromagnetic compatibility in other environments, due to conducted as well as radiated disturbances.

Safety precautions

Review and follow the safety instructions below :

Symbol	Meaning
	Caution and Warning
	Protective earth (Ground)
CE	This instrument and consumables conforms to the EC Declaration of Conformity.
FCC Compliance	This equipment has been tested and found to comply with the limits for a Class A digital instrument, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Product specifications

Items	Specification
Light source	Blue, Green, UV LED (Intensity adjustable)
Objective lens	4 X, 10 X & 20 X (Olympus) + Digital Zoom
Fluorescence	3 fluorescence DAPI: Excitation 390/40, Emission 452/45 GFP: Excitation 466/40, Emission 525/50 RFP: Excitation 525/50, Emission 580LP
Camera	High-sensitivity monochrome CCD (Sony sensor 2/3") 1,936 x 1,456 pixels (2.8 M), 53 FPS, 14 bit
Stage	Automated X-Y-Z Stage Ex-changeable vessel holders
Exported formats	Image: JPEG, PNG, TIFF, BMP Movie: AVI Raw data: CSV
PC requirement	OS Widows 8 Monitor (Resolution 1920 x 1080 pixels)
Operating power	100 – 240 V, 1.5 A, 50/60 Hz
Electronic input	12VDC, 5.0A
Dimensions	429 (W) X 310 (D) X 324 (H) mm
Weight	18.0 kg / 39.7 lbs
Operating environment	5 - 40 ℃, 20 - 95 %

Ordering information

Cat. No.	Description	Contents
JS1000S	JuLI™ Stage Starter pack	JuLI™ Stage basic set (JS1000), All-in-one touch screen PC (JS0100),3 Objective lens (4X, 10X, 20X)
JS1000	JuLI™ Stage, Automated cell imaging system	Main device, Power supply, Control box
JP0100	JuLI™ Stage, All-in-one touch screen PC	CPU: Intel Core i5-4590S Processor (Qual Core, 6MB, 3.00GHz) OS: Genuine Windows 8.1 64bit (ENG) RAM: 8 GB (2x4 GB) 1600MHz DDR3L Memory HDD: 1TB 2.5" SATA (5,400 Rpm) 23" Full HD (1920 X 1080) with touch screen
JP0150	JuLI™ Stage, External hard disk rive (Optional)	Total 8 TB (4 TB x 2 ea)
JO0004	JuLI™ Stage, Objective lens (4 X) (Optional)	Magnification: 4 X, NA: 0.16
JO0010	JuLI™ Stage, Objective lens (10 X) (Optional)	Magnification: 10 X, NA: 0.3
JO0020	JuLI™ Stage, Objective lens (20 X) (Optional)	Magnification: 20 X, NA: 0.45
JVH001	JuLI™ Stage, Vessel holder Micro Slide (25 x 75 mm), (Optional)	1 pc, Holds two standard microscope slides
JVH002	JuLI™ Stage, Vessel holder Petri Dish (35 mm), (Optional)	1 pc, Holds two 35 mm petri dishes
JVH003	JuLI™ Stage, Vessel holder Petri Dish (60 mm), (Optional)	1 pc, Holds two 60 mm petri dishes
JVH004	JuLI™ Stage, Vessel holder Petri Dish (100 mm), (Optional)	1 pc, Holds one 100 mm petri dish
JVH005	JuLI™ Stage, Vessel holder T-Flask (25 & 75 cm^2), (Optional)	1 pc, Holds one T-25 flask 1 pc, Holds one T-75 flask

Technical support

Visit our Website at **www.nanoentek.com for :**

- · Technical resources, including manuals, FAQs, etc.
- · Technical support contact information
- · Additional product information and special offers.

For more information or technical assistance, please call or email.

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JuLI™ Stage

Automated cell imaging system

NESMU-JST-001E (V.0.5)

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